SUNWAY UNIVERSITY
A CLASS ABOVE

PROGRAMME BOOK

11th International Conference on High Level Environmental Radiation Areas (ICHLERA-11)

Global Collaboration for Radiation Monitoring and Remediation

2024

School of ENGINEERING & TECHNOLOGY

Research Centre for CARBON DIOXIDE CAPTURE & UTILIZATION

APPLIED PHYSICS & RADIATION TECHNOLOGIES GROUP

ALYPZ

Jeffrey Cheah Foundation
Nurturing the Seeds of Wisdom

WELCOME MESSAGES

Professor Sibrandes Poppema

President of Sunway University

It is my pleasure to extend a warm welcome to all esteemed speakers, guests and participants at the 11th International Conference on High Level Environmental Radiation Areas (ICHLERA-11). It is both a pleasure and an honour to host this conference and to bring together such a diverse group of experts in the field of high-level environmental radiation.

As we face increasing risk from high-level environmental radiation, the need for urgent and innovative solutions has never been greater. Tackling these issues demands advanced technologies for monitoring, shielding, and remediation. It is crucial that scientists from various disciplines collaborate to develop and implement effective strategies for ensuring safety of human and environmental health.

At Sunway University, we are committed to supporting the Sustainable Development Goals and enhancing planetary health. Through Research Centre for Carbon Dioxide Capture and Utilization, we strive to advance research and education in Applied Physics and Radiation Sciences. ICHLERA conference marks a significant milestone as it is being hosted for the first time at Sunway University and Malaysia as well.

I would like to express my deepest gratitude to all the distinguished speakers, organizing committee members, session chairs, paper contributors, and sponsors for their invaluable contributions to making this conference a success. I wish everyone a productive and successful conference.

Professor Sibrandes Poppema
President
Sunway University

Professor Ir. Denny Ng Kok Sum

Dean of School of Engineering and Technology, Sunway University

It is my pleasure to welcome all of the participants to Sunway University for the 11th International Conference on High-Level Environmental Radiation Areas (ICHLERA-11)!

This conference is dedicated to the crucial field of high-level environmental radiation. We are thrilled to host this gathering of distinguished delegates from around the globe, united by the shared commitment to tackling the challenges of excessive radiation exposures in our time.

The escalating threat posed by high-level environmental radiation underscores the urgent need for innovative and effective solutions. As we confront these challenges, it is clear that advanced technologies in monitoring, protection, and remediation are not just necessary but essential. Our collective efforts must focus on developing and implementing strategies that ensure both environmental safety and public health.

This conference serves as a crucial platform for fostering collaboration among researchers and professionals from diverse disciplines. By pooling our expertise and resources, we can devise comprehensive solutions that address the complexities of environmental radiation. Together, we are not only advancing scientific knowledge but also paving the way for practical applications that will safeguard our planet and future generations.

Thank you for your participation and contributions. Let us work together to drive progress and innovation in this vital field.

I wish you all a productive and inspiring conference.

Professor Ir. Denny Ng Kok Sum
Dean
School of Engineering and Technology
Sunway University

Professor Mayeen Uddin Khandaker

Chairman of ICHLERA-11, Sunway University

Distinguished guests, esteemed colleagues, and fellow researchers,

On behalf of the organizing committee, I am honoured to welcome you all to the 11th International Conference on High Levels of Environmental Radiation Areas (ICHLERA-11) at Sunway University, Malaysia.

As you know, radiation exposure is a fact of life. We encounter ionizing radiation from both natural and man-made sources. While regulations for man-made exposure have been established for nearly a century by organizations like the International Commission on Radiological Protection (ICRP), the effects of natural radiation have remained a scientific puzzle.

For far too long, the health risks associated with natural radiation exposure haven't received the same level of attention as those from man-made sources. This continuous, low-dose exposure has largely been absent from epidemiological studies used for risk assessment and regulation. To bridge this gap in knowledge, a series of international conferences began in 1977 in Brazil, with the first focusing on natural radiation exposure. Over the years, these conferences have evolved to encompass high levels of environmental radiation from all sources, both natural and man-made. The focus remains on understanding the health effects and social impacts on populations living in such areas.

The 10th ICHLERA, held in 2022 at the University of Strasbourg, France, further expanded this scope. We are thrilled to be hosting the 11th ICHLERA here in Malaysia, building on this valuable legacy. This conference serves as a platform for researchers and experts to share cutting-edge knowledge on radiation exposure, its health consequences, and the social implications for affected communities. Through collaborative efforts, we aim to **Estimate Risks, Understand Health Effects** and **Develop Solutions**. The three-day programme will be filled with presentations, discussions, and the exchange of ideas. I encourage you to actively participate, share your expertise, and forge new collaborations. Together, let's make significant strides in this crucial field and work towards a future where everyone, regardless of their environment, can live healthy and fulfilling lives.

Thank you, and welcome once again to the 11th ICHLERA!

Professor Mayeen Uddin Khandaker
Chairman of ICHLERA-11
Applied Physics and Radiation Technologies Group
Research Centre for Carbon Dioxide Capture and Utilisation
School of Engineering and Technology, Sunway University

Professor Mohamed Kheireddine Aroua

Head & Distinguished Professor of Research Centre for Carbon Dioxide Capture and Utilisation, Sunway University

Welcome to Sunway University and the 11th International Conference on High-Level Environmental Radiation Areas (ICHLERA-11)!

It is both a pleasure and a profound honour to host this prestigious conference, which brings together an exceptional array of esteemed guests, distinguished speakers, and dedicated participants from across the globe. We are truly excited to convene this vibrant and knowledgeable community of experts, all united by our shared commitment to tackling the pressing challenges posed by high-level environmental radiation.

In an era where environmental radiation risks are increasingly prevalent, the imperative for innovative and effective solutions has never been more critical. The complexities inherent in monitoring, shielding, and remediating radiation exposure demand the application of advanced technologies and a concerted, interdisciplinary approach. ICHLERA-11 stands as a pivotal platform for fostering such collaborations. Over the course of this conference, we will explore new strategies and solutions designed to enhance both environmental safety and public health.

At Sunway University, our dedication to advancing the Sustainable Development Goals and promoting planetary health is reflected through our centre initiative at Research Centre for Carbon Dioxide Capture and Utilization. Hosting ICHLERA-11 for the first time in Malaysia represents a significant milestone in our ongoing efforts to contribute to this vital field. We are honoured to welcome the distinguished guests from different countries, each bringing their latest research, innovations, and insights to share with us.

I extend my deepest gratitude to all who have contributed to the success of this conference: our esteemed speakers, dedicated moderators, insightful paper contributors, the organizing committee members, and our generous sponsors. Your invaluable support and participation are the cornerstones of this event's success, and we are immensely grateful for your commitment.

Thank you for being part of this important gathering. I wish you all a productive, engaging, and inspiring conference experience. Together, let us drive forward progress and innovation in the critical field of environmental radiation, and work towards ensuring a safer, healthier future for all.

Professor Mohamed Kheireddine Aroua
Head & Distinguished Professor, Research Centre for Carbon Dioxide Capture and Utilisation
School of Engineering and Technology, Sunway University

TABLE OF CONTENTS

ICHLERA-11 COMMITTEE MEMBERS

Conference Chairs

Professor Mayeen Uddin Khandaker, Sunway University, Malaysia

Distinguished Professor David Andrew Bradley, Sunway University, Malaysia

National Distinguished Professor Mehdi Sohrabi, ICHLERA President, Amirkabir University of Technology, Iran

Host Organising Committee Members

Professor Mayeen Uddin Khandaker, Sunway University

Distinguished Professor David Andrew Bradley, Sunway University

Distinguished Professor Mohamed Kheireddine Aroua, Sunway University

Associate Professor Farihahusnah Hussin, Sunway University

Dr. Lam Siok Ee, Sunway University

Dr. Mohd Azlan Kassim, Sunway University

Dr. Rabita Mohd Firdaus Achutan, Sunway University

Dr. Siti Nurasiah Mat Nawi, Sunway University

Dr. Siti Rozaila Binti Zahariman, Sunway University

Mr. Ali Taheri, Sunway University

Ms. Anne Lawai Awan, Alypz Sdn. Bhd.

Scientific Secretary

Dr. Lam Siok Ee, Sunway University

Treasurer

Mdm. Aisha Ridzuan, Sunway University

International Scientific Committee Members

A. Chandrasekaran, India
A. Nourreddine, Strasbourg University, France
J. Chen, Radiation Protection Bureau, Canada
S. Akiba, Japan
A. Wojcik, Stockholm University, Sweden
Afroza Shelley, University of Dhaka, Bangladesh
B. Batandjieva-Metcalf, UNSCEAR, Austria
D. Pressyanov, Sofia University, Bulgaria
D. A. Bradley, Sunway University, Malaysia
E. Cardis, Spain
E. J. Calabrese, University of Massachusetts Amherst, USA
F. Bochicchio, Istituto Superiore di Sanità, Italy
Hamid Osman, Saudi Arabia
I. Kashiwakura, Japan
J. McLaughlin, University College Dublin, Ireland
K. A. Naseer, India
Kholoud S. Almogren, Saudi Arabia
L. Font Guiteras, Universitat Autònoma de Barcelona, Spain
M. Hosoda, Hirosaki University, Japan
M. Sohrabi, Amirkabir University of Technology, Iran
M. M. Mahfuz Siraz, Bangladesh
Matthew Isinkaye, Nigeria
Mohamed Y. Hanf, Russian Federation
Mohammed Alkhorayef, Saudi Arabia
M. U. Khandaker, Sunway University, Malaysia
N. Nagaiah, India
P. J. Jojo, Papua Newguinea
Phannee Saengkaew, Thailand
Q. Sun, China
R. Barillon, Strasbourg University, France
R. C. Ramola, HNB Garhwal University, India
S. Tokonami, Hirosaki University, Japan
S. L. Simon, National Institutes of Health, USA
Sk. A. Latif, Saudi Arabia
T. Kovacs, University of Pannonia, Hungary
T. Tommasino, Italy
Tareq Alrefae, Kuwait
M. Balonov, Research Institute of Radiation Hygiene, Russian Federation
P. Bossew, German Federal Office for Radiation Protection, Germany
M. I. Sayyed, Isra University, Jordan

Local Scientific Committee Members

Professor Dr. Ahmad Taufek Abdul Rahman, Universiti Teknologi MARA

Assistant Professor Azni Abdul Aziz, International Islamic University Malaysia

Professor Ts. Dr. Faizal K.P. Kunchi Mohamed, Universiti Kebangsaan Malaysia

Professor Ir. Dr. Hairul Azhar Abdul Rashid, Multimedia University

Professor Dr. Jeannie Wong Hsiu Ding, University of Malaya

Associate Professor Dr. Mohd Hafiz Mohd Zin, Universiti Sains Malaysia

Associate Professor Dr. Muhammad Khalis Abdul Karim, Universiti Putra Malaysia

Associate Professor Dr. Noramaliza Mohd Noor, Universiti Putra Malaysia

Associate Professor Dr. Rafidah Zainon, Universiti Sains Malaysia

Ts. Dr. Ratna Suffhiyanni Omar, Universiti Kebangsaan Malaysia

Associate Professor Dr. Siti Fairus Abdul Sani, University of Malaya

Professor Dr. Suhairul Hashim, Universiti Teknologi Malaysia

Professor Dr. Ung Ngie Min, University of Malaya

Professor Dr. Yeong Chai Hong, Taylor's University

CONFERENCE PROGRAMME

Day 1, Monday, 28th October 2024

TIME	PROGRAMME	VENUE
08:00 am – 09:00 am	**Registration**	JC3
OPENING CEREMONY Chair: Prof. Mayeen Uddin Khandaker Emcee: Prof. Ts. Dr. Faizal K.P. Kunchi Mohamed		
9:00 am – 9:15 am 9:15 am – 9:20 am 9:20 am – 9:25 am 9:25 am – 9:30 am 9:30 am – 9:45 am	National Anthem, Negaraku Recitation of Doa Welcoming Remarks by **Professor Mayeen Uddin Khandaker**, Chairman of the 11th International Conference on High Level Environmental Radiation Areas (ICHLERA-11), Sunway University Officiating Remarks by **Professor Sibrandes Poppema**, President of Sunway University Officiating Remarks by **YBrs. Puan Hajah Noraishah binti Pungut**, Director General of Department of Atomic Energy Malaysia, Ministry of Science, Technology and Innovation (MOSTI) Launch Presentation Souvenir Presentation Group Photograph	JC3
Chair: Prof. Mayeen Uddin Khandaker Co-Chair: Prof. Ts. Dr. Faizal K.P. Kunchi Mohamed		
09:45 am – 10:30 am	**Plenary Speaker:** *YBrs. Puan Hajah Noraishah binti Pungut* *Director General of Department of Atomic Energy Malaysia, MOSTI* **Advancing Radiation Protection for Safety Culture**	JC3
10:30 am – 10:45 am	Coffee Break + Onsite Poster Session	JC3
10:45 am – 11:30 am	**Plenary Speaker:** *Prof. Mehdi Sohrabi* *National Distinguished Professor, Amirkabir University of Technology, Iran* **State-of-the-Art Advances on Novel Universal Radiation Protection System**	JC3
SESSION 1A: ENVIRONMENTAL MONITORING & DOSE ASSESSMENT Chair: Distinguished Prof. David Bradley Co-Chair: Dr. Lam Siok Ee		
11:30 am – 11:50 am	**Talk 1:** *Prof. Dr. N Nagaiah, Bangalore University, India*	JC3

	Investigation on the Concentration of Uranium in Potable Water of Bangalore, India – A Comprehensive Study (ICHLERA11-25)	
11:50 am – 12:10 pm	**Talk 2:** *Prof. Mayeen Uddin Khandaker, Sunway University, Malaysia* **Identification of High-Level Background Radiation Areas and Assessing Radiation Exposure in Malaysia** (ICHLERA11-58)	JC3
12:10 pm – 12:30 pm	**Talk 3:** *Prof. Tsi-chain Chao, Chang Gung University, Taiwan* **Radiation Risk Assessment for NTHU Biotechnology Building: Feasibility Study** (ICHLERA11-28)	JC3
12:30 pm – 12:50 pm	**Talk 4:** *Dr. Chandrasekaran Ananthanarayanan, SSN College of Engineering (Autonomous), India* **External Gamma Ray Dose Assessment to Population along the Southern Coastal Area of Tamil Nadu with Statistical Approach** (ICHLERA11-08)	JC3
01:00 pm – 02:00 pm	Lunch	Chak's, Level M
SESSION 2: RADIATION EMERGENCY MEDICINE Chair: Prof. Dr. N Nagaiah Co-Chair: Dr. Rabita Mohd Firdaus Achutan		
02:00 pm – 02:30 pm	**Invited Talk 1:** *Prof. Shinji Tokonami* *Director of Institute of Radiation Emergency Medicine,* *Hirosaki University, Japan* **An Experimental Review of ICRP Lung Model for Radon/Thoron Progeny Inhalation**	JC3
02:30 pm – 03:00 pm	**Invited Talk 2:** *Prof. Jojo Panakal John* *Head of Biomedical Engineering Section, Papua New Guinea University of Technology, Papua New Guinea* **Living with Radiation: A Comparative Health Impact Evaluation in High Background Radiation Area in India with Normal Regions in PNG**	JC3
SESSION 3: RADIOBIOLOGICAL EFFECTS, EPIDEMIOLOGY & HEALTH IMPACTS Chair: Assoc. Prof. Muhammad Khalis Bin Abdul Karim Co-Chair: Dr. Siti Nurasiah Mat Nawi		
03:00 pm – 03:20 pm	**Talk 5:**	JC3

	Mrs. Hauwau Kulu Shuaibu, Universiti Kebangsaan Malaysia, Malaysia **Natural Radioactivity Levels and Radiological Risks in Some Medicinal Plants Consumed in Northern Nigeria** (ICHLERA11-17)	
03:20 pm – 03:40 pm	**Talk 6:** *Mr. Ali Taheri, Sunway University, Malaysia* **Dosimetric and Radiobiological Impacts of Radon Exposure on Skin: A Monte Carlo Simulation Study** (ICHLERA11-21)	JC3
03:40 pm – 04:10 pm	Coffee Break + Onsite Poster Session	JC3
SESSION 4: MAN-MADE SOURCES AND HANDLING OF HUMAN EXPOSURES & RESPONSIBILITIES Chair: Prof. Jojo Panakal John Co-Chair: Dr. Siti Rozaila Zahariman		
04:10 pm – 04:30 pm	**Talk 7:** *Mr. Bashiru Lukuman, Universiti Putra Malaysia, Malaysia* **Regression Analysis of Body-Mass Index and Radiation Dosimetry of Whole-Body PET/CT Using Machine Learning Algorithm** (ICHLERA11-51)	JC3
04:30 pm – 04:50 pm	**Talk 8:** *Dr. Zuhal Yassin Ali Hamd, Princess Nourah bint Abdulrahman University, Saudi Arabia* **Assessing Occupational Radiation Exposure Trends and Safety Interventions for Healthcare Professionals at a University Hospital in Saudi Arabia (2020-2022)** (ICHLERA11-02)	JC3
END OF DAY 1		
06:30 pm – 10:00 pm	**Conference Dinner**	Sunset Terrace, Sunway Resort Hotel

POSTER PRESENTATION DAY 1		
TIME	**POSTER DETAILS**	**VENUE**
09:00 am – 05:00 pm	**ICHLERA11 – 01** *Prof. Kholoud Saad Almugren* *Princess Nourah bint AbdulRahman University, Saudi Arabia* **Exploring the Efficacy of High dose rate (HDR) Brachytherapy based on Ultrasound-Guided for Prostate Cancer Treatment: A Novel Approach at KFMC (Saudi Arabia)**	Poster Display Area, JC3
	ICHLERA11 – 04 *Ms. Marzieh Hassanpour Choubehsani* *Universiti Kebangsaan Malaysia, Malaysia* **Identification of Alkaline and Sulphate Elements in Cement Using PGNAA Method:** **A Monte Carlo Simulation Approach**	
	ICHLERA11 – 07 *V. Sathish* *Department of Physics, Sri Sivasubramaniya Nadar College of Engineering, Kalavakkam, Chennai, India* **Effect of heavy minerals on natural radioactivity on the coastal area of North Chennai to Pondicherry, India**	
	ICHLERA11 – 09 *Ms. G Poongodi* *Sri Sivasubramaniya Nadar College of Engineering (Autonomous), India* **Natural radioactivity and the associated radiation hazards in coal and ash samples collected from Tamil Nadu, India**	
	ICHLERA11 – 16 *Ms. Karthikayini* *Sri Sivasubramaniya Nadar College of Engineering, India* **Assessment of Natural radioactivity in Bricks samples of Tamil Nadu, India using Gamma-ray spectrometry**	
	ICHLERA11 – 18 *Mrs. Azlina Binti Baha* *Universiti Teknologi Malaysia (UTM), Malaysia* **Radiological Impact of Natural Radioactivity in Malaysian Building Bricks**	
	ICHLERA11 – 23	

	Professor Afroza Shelley *Department of Nuclear Engineering, University of Dhaka, Bangladesh* **Radiological Assessment of Sand Samples near Rooppur Nuclear Power Plant: Implications for Environmental Safety**	
	ICHLERA11 – 31 *Ms. Deepika D N* *Department of Physics, Bangalore University, India* **Study of 226Ra and Dissolved Radon Activity Concentration in Ground Water Samples of locations around Manchanabele Reservoir, Bengaluru, Karnataka, India**	
	ICHLERA11 – 35 *Dr. Farhad Moradi* *Fiber Optics Research Center, Faculty of Engineering, Multimedia University, Cyberjaya, Malaysia* **Suggesting a photon energy discriminating method using a radioluminescence dosimetry system: Application to workplace and environmental monitoring**	
	ICHLERA11 – 36 *Dr. Halmat Jalal Hassan* *Department of Physics, College of Education, University of Sulaimani, Sulaimani, 46001, Kurdistan-Iraq* **Radiation Hazards and Effective Dose Evaluation: A Study of Various Imported Walnut Consumed in Kurdistan-Iraq**	
	ICHLERA11 – 40 *Dr. Hoang Sy Minh Tuan* *Thu Dau Mot University, Vietnam* **Radiological Impact Assessment of Fly Ash Utilization in Vietnamese Construction: A Case Study on NORM**	
	ICHLERA11 – 42 *Mr. Mehdi Hassanpour Choubeh Sani* *Space Science Centre (ANGKASA), Institute of Climate Change (IPI), Universiti Kebangsaan Malaysia, Malaysia.* **Predicting Radioactive Material Dispersion from the Zaporizhzhia Nuclear Power Plant Using LSTM and RNN Models**	
	ICHLERA11 – 52 *Assoc. Prof. Muhammad Khalis Abdul Karim* *Department of Physics, Universiti Putra Malaysia, Malaysia*	

	Simulation and Risk Assessment of Radiological Dispersal Device (RDD) Attacks in Major Southeast Asian Cities using HYSPLIT Modelling	
END OF DAY 1		

Day 2, Tuesday, 29th October 2024

TIME	PROGRAMME	VENUE
Chair: Prof. Mayeen Uddin Khandaker		
09:00 am – 09:30 am	**Invited Talk 3:** *Distinguished Prof. David Andrew Bradley* *Sunway University, Malaysia* **A Forward-Looking Perspective on Exposures, Dosimetry and Applications**	JC3
SESSION 1B: ENVIRONMENTAL MONITORING & DOSE ASSESSMENT Chair: Distinguished Prof. Mohamed Kheireddine Aroua Co-Chair: Assoc. Prof. Ts. Dr. Farihahusnah Hussin		
09:30 am – 09:50 am	**Talk 9:** *Mr. Farid Bajuri, Universiti Putra Malaysia, Malaysia* **Extravehicular Smart Optical Fibre for Passive Dosimetry in Space (E-SOFPADS)** (ICHLERA11-37)	JC3
09:50 am – 10:10 am	**Talk 10:** *Dr. Chandrasekaran Ananthanarayanan, SSN College of Engineering (Autonomous), India* **Assessment of Impact of Physico-Chemical Properties and Minerals on Natural Radionuclides and the Associated Radiation Hazards in Beach Sediments Along the Hotspot Tourist Area of Kovalam at Chennai, Tamil Nadu** (ICHLERA11-22)	JC3
10:10 am – 10:30 am	**Talk 11:** *Assoc. Prof. Yasutaka Omori, Hirosaki University, Japan* **Spatial distribution of ambient gamma dose rates in Aksu, a radon-prone area of northern Kazakhstan** (ICHLERA11-48)	JC3
10:30 am – 11:00 am	Coffee Break & Onsite Poster Session	JC3
11:00 am – 11:30 am	**Invited Talk 4:** *Dr. Huda Al-Sulaiti* *Senior Research Director, Natural and Environmental Hazards Observatory, Qatar Environment and Energy Research Institute*	JC3

	Environmental Radioactivity Hazards Measuring the Invisible	
SESSION 5: NORM & TENORM Chair: Distinguished Prof. David Bradley Co-Chair: Assoc. Prof. Siti Fairus Abdul Sani		
11:30 am – 12:00 pm	**Invited Talk 5:** *Ms. Anne Lawai Awan* *Chief Operating Officer, Alypz Sdn. Bhd., Malaysia* **NORM Monitoring at Oil and Gas Operations in Malaysia**	JC3
12:00 pm – 12:20 pm	**Talk 12:** *Mr. Adi Wijayanto, Universiti Teknologi Malaysia, Malaysia* **Radiological Assessment of Building Materials Containing Radionuclide Substances in Muria Peninsula, Indonesia** (ICHLERA11-20)	JC3
12:20 pm – 12:40 pm	**Talk 13:** *Mr. Radhia Pradana, Hirosaki University, Japan* **Investigation of Radiation Exposure at Tin Smelting Plants in Bangka, Indonesia** (ICHLERA11-24)	JC3
12:40 pm – 01:00 pm	**Talk 14:** *Prof. Matthew Omoniyi Isinkaye, Ekiti State University, Nigeria* **Elevated Naturally Occurring Radioactive Materials (NORMs) in Groundwater of Artisanal Gold and Gemstone Mining Sites** (ICHLERA11-10)	JC3
01:00 pm – 02:00 pm	Lunch	Chak's, Level M
02:00 pm – 02:20 pm	**Talk 15:** *Mr. Razali Harun, Universiti Kebangsaan Malaysia.* **Safe Handling and Management of Industrial Residues Containing Naturally Occurring Radioactive Materials (NORM)** (ICHLERA11-19)	JC3
SESSION 6: REGULATORY CONTROL & RESPONSIBILITIES AND NOVEL RADIATION PROTECTION PHILOSOPHY & CONCEPTS Chair: Assoc. Prof. Yasutaka Omori Co-Chair: Assistant Prof. Azni Abdul Aziz		
02:20 pm – 02:40 pm	**Talk 16:** *Dr. Teng Iyu Lin, Department of Atomic Energy, Malaysia*	JC3

	Licensing and Enforcement Activities for Facilities Dealing with Naturally Occurring Radioactive Materials (NORM) (ICHLERA11-15)	
02:40 pm – 03:00 pm	**Talk 17:** *Mr. Husain Bin Murat, Universiti Putra Malaysia, Malaysia* **Assessment of Typical Dose Values for Establishing DRLs of Whole-Body 18F-FDG PET/CT Scan in Malaysia Cancer Centre** (ICHLERA11-14)	JC3
03:00 pm – 03:30 pm	Coffee Break & Onsite Poster Session	JC3
SESSION 7: ENVIRONMENTAL MODELLING FOR RADIATION PROTECTION Chair: Dr. Chandrasekaran Ananthanarayanan Co-Chair: Dr. Mohd Azlan Kassim		
03:30 pm – 03:50 pm	**Talk 18:** *Assoc. Prof. Dr. Othman Abdulrahman Fallatah, King Abdulaziz University, Saudi Arabia* **A Multi-Disciplinary Approach to Assessing Natural Radioactivity in Groundwater Samples in High Background Areas Based on ML, GIS and RS** (ICHLERA11-13)	JC3
03:50 pm – 04:10 pm	**Talk 19:** *Mr. Bharath, Mangalore University, India* **Application of Computational Fluid Dynamics (CFD) Modelling for Predicting the Transport and Dispersion of $^{14}CO_2$ in the Atmospheric Air in the Vicinity of a Nuclear Power Plant** (ICHLERA11-39)	JC3
04:10 pm – 04:30 pm	**Talk 20:** *Mr. Mehdi Hassanpour Choubeh Sani, Universiti Kebangsaan Malaysia, Malaysia* **Evaluation of Jute/Polyester and Glass/Polyester as Shielding Materials for the International Space Station (ISS) Against Cosmic Radiation** (ICHLERA11-43)	JC3
END OF DAY 2		

POSTER PRESENTATION DAY 2		
TIME	**POSTER DETAILS**	**VENUE**
09:00 am – 05:00 pm	**ICHLERA11 – 32** *Dr. Dariush Sardari* *Dept. Medical Radiation Engineering, Science and Research Branch, Islamic Azad University, Tehran, Iran* **Computation of dose distribution in brain for very high energy electron radiotherapy**	Poster Display Area, JC3
	ICHLERA11 – 41 *Dr. Hoang Sy Minh Tuan* *Thu Dau Mot University, 6 Tran Van On, Phu Hoa Ward, Thu Dau Mot City, Binh Duong, Vietnam, 820000.* **Environmental Radiation Monitoring in Northern Vietnam: Baseline Data for Transboundary Radiation Risk Assessment**	
	ICHLERA11 – 45 *Professor Fang-Yuh Hsu* *National Tsing Hua University, 101 sec.2, Kuang-Fu rd., Hsinchu City 300, Taiwan.* **Validation of a Radiation Discrimination Technique for Mixed Neutron–Photon Fields Involving the Use of a Tissue Equivalent Counter**	
	ICHLERA11 – 46 *Dr. Hoang Sy Minh Tuan* *Thu Dau Mot University, Vietnam* **Natural Radioactivity in Cement: An Assessment of Construction Materials in Ho Chi Minh City**	
	ICHLERA11 – 47 *Dr. Azni Binti Abdul Aziz* *Department of Physics, Kulliyyah of Science, International Islamic University Malaysia, Kuantan Campus, 25200 Kuantan, Pahang* **Mapping The Airborne Distribution of Caesium-137 in the Asia Pacific Region Using Data From The Comprehensive Nuclear Test-Ban Treaty**	
	ICHLERA11 – 49 *Ms. Norhayati binti Abdullah* *Jabatan Radiologi, Fakulti Perubatan dan Sains Kesihatan, Universiti Putra Malaysia, 43400 Serdang, Selangor* **Comparison of absorbed dose measurement using fabricated Germanium doped optical fibres, nanoDot OSLD and TLD-100 in high radiation level**	

	ICHLERA11 – 50 *Prof. Abdelfettah Belafrites* *Department of Physics, University of Jijel, BP 98, Ouled Aissa, Jijel, Dz-18000, Algeria* **Algerian soil and phosphate sample radioactivity levels and the associated radiological risk index assessment**	
	ICHLERA11 – 54 *Dr. Satvir Singh* *CT University, Ludhiana, Punjab, India* **Distribution of Uranium in groundwater of Tarn-Taran district of Punjab and its remediation using NdFeO3 perovskite**	
	ICHLERA11 – 56 *Mrs. Ku Shaidaton Akmar Binti Ku Bakar* *Department of Radiology, Faculty of Medicine and Health Sciences, 43400 UPM Serdang, Selangor Darul Ehsan.* **Novel Fabricated Germanium-doped Optical Fibres as High Absorbed dose Measurement Detector for Mapping Gamma-ray Cesium-137**	
	ICHLERA11 – 57 *Assoc. Prof. Noramaliza Mohd Noor* *Department of Radiology, Faculty of Medicine and Health Sciences, 43400 UPM Serdang, Selangor Darul Ehsan* **A Trial Run of Passive Radiation Monitoring using Fabricated Germanium-doped Silica Optical Fibres Personal Dosimeter Badge (SOFPeD) in High Radiation Environments**	
	ICHLERA11 – 62 *Dr. Ratna Suffhiyanni Binti Omar* *Department of Applied Physics, Faculty of Science and Technology, Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor, Malaysia* **Optimizing CT Dose Accuracy and Patient Safety: A Comparative Evaluation Across Five Scanner Models in Malaysian Hospitals**	
END OF DAY 2		

Day 3, Wednesday 30th October 2024

TIME	PROGRAMME	VENUE
Chair: Prof. Mayeen Uddin Khandaker		
09:00 am – 09:30 am	**Invited Talk 6:** *Prof. Ir. Dr. Hairul Azhar Abdul-Rashid* *Vice President (Market Exploration, Engagement and Touchpoints), Multimedia University, Malaysia* **Development of Radiation Survey Meter with Extendable Optical Fiber Probe**	JC3
SESSION 1C: ENVIRONMENTAL MONITORING & DOSE ASSESSMENT Chair: Prof. Ir. Dr. Hairul Azhar Abdul-Rashid Co-Chair: Dr. Mohd Azlan Kassim		
09:30 am – 09:50 am	**Talk 21:** *Mr. Muhammad Nazmi Bin Mazlan, Universiti Kebangsaan Malaysia, Malaysia* **Assessment of Thyroid Counter Accuracy Using Caesium-137 and Europium-152 Radionuclides** (ICHLERA11-61)	JC3
09:50 am – 10:10 am	**Talk 22:** *Mr. Shakeel J / Augustine Wisely Bezalel, SSN College of Engineering (Autonomous), India* **Determination of Natural Radioactivity in Soil Samples Collected from Pallikaranai Solid Waste Dumping Site in Chennai, Tamil Nadu** (ICHLERA11-05)	JC3
10:10 am – 10:30 am	**Talk 23:** *Mr. V. Sathish, SSN College of Engineering (Autonomous), India* **Gross alpha-beta activities and gamma dose measurements of surface sediments along the North Chennai to Pondicherry coast, India** (ICHLERA11-26)	JC3
10:30 am – 11:00 am	Coffee Break & Onsite Poster Session	JC3
Chair: Prof. Ismail Md. Mofizur Rahman Co-Chair: Dr. Lam Siok Ee		
11:00 am – 11:30 am	**Invited Talk 7:** *Dr. Husaini Bin Salleh* *President of Malaysian Radiation Protection Association (MARPA)* **Living with Radiation: Something that We Should Know**	JC3

11:30 am – 12:00 pm	**Invited Talk 8:** *Prof. Dr. Suhairul Bin Hashim* *Universiti Teknologi Malaysia, Malaysia* **Radiological and Elemental Analysis of Indoor Tiles in Malaysia: Implications for Public Health**	JC3
SESSION 8: RADON, THORON & DECAY PRODUCTS MEASUREMENTS Chair: Prof. Dr. Suhairul Bin Hashim Co-Chair: Dr. Ratna Suffhiyanni Omar		
12:00 pm – 12:20 pm	**Talk 24:** *Mrs. Noor Fadilla Binti Ismail, Universiti Teknologi Malaysia and Malaysian Nuclear Agency, Malaysia* **Geospatial Mapping of ^{222}Rn Risk in Malacca and Negeri Sembilan, Malaysia: Assessment of ^{222}Rn Activity Concentration in Soil Gas and Soil Permeability** (ICHLERA11-67)	JC3
12:20 pm – 12:40 pm	**Talk 25:** *Dr. Truong Van Minh, Dong Nai University, Vietnam* **Radon Concentration Measurement in Domestic Water for Some Areas in Bien Hoa City Using RAD7** (ICHLERA11-33)	JC3
12:40 pm – 01:00 pm	**Talk 26:** *Mr. Vijith A P, Mangalore University, India* **Study of Long-Term Behavior of Unattached ^{222}Rn Progeny Fraction in Controlled Conditions of a Walk-In Type Chamber** (ICHLERA11-38)	JC3
01:00 pm – 2:00 pm	Lunch	Chak's, Level M
Chair: Prof. Dr. Suhairul Bin Hashim Co-Chair: Dr. Ratna Suffhiyanni Omar		
02:00 pm – 2:20 pm	**Talk 27:** *Dr. Muhammad Safwan Bin Ahmad Fadzil, Universiti Kebangsaan Malaysia, Malaysia* **Monitoring Occupational Radiation Exposure and Safety Measures among Radiological Technologist Trainees in Malaysia: A Five-Year Experience** (ICHLERA11-29)	JC3
02:20 pm – 02:40 pm	**Invited Talk 9:** *Dr. A. Chandrasekaran* *SSN College of Engineering, India* **Radioactivity Measurement in Beach Sediments, Soil, Building Materials, and Fertilizers Collected from Tamil Nadu, India**	

02:40 pm – 03:10 pm	Coffee Break & Onsite Poster Session	JC3
SESSION 9: NUCLEAR POWER PLANT ACCIDENTS & RISK COMMUNICATION Chair: Prof. Mayeen Uddin Khandaker Co-Chair: Dr. Siti Nurasiah Mat Nawi		
03:10 pm – 03:30 pm	**Talk 28:** *Prof. Ismail Md. Mofizur Rahman, Fukushima University, Japan* **Application of a Crown Ether-Functionalized Mesoporous Silica Sorbent for Radiocesium Removal from Fukushima-Originated Wastewater** (ICHLERA11-11)	JC3
03:30 pm – 03:50 pm	**Talk 29:** *Dr. Zinnat Ara Begum, Fukushima University, Japan* **Dispersant-Induced Migration of Radiocesium in Contaminated Soils: Implications for Soil Decontamination in Fukushima** (ICHLERA11-12)	JC3
03:50 pm – 04:10 pm	**Talk 30:** *Mr. Bernardo Salas Mar, Universidad Nacional Autónoma de México, Mexico* **Radiologically Contaminated Workers at the Laguna Verde Nuclear Power Plant – MEXICO** (ICHLERA11-03)	JC3
04:10 pm – 04:30 pm	**Talk 31:** *Ms. Tamilarasi A, SSN College of Engineering, India* **Radiological Risk Factors and Mineralogical Characterization of the Clay Samples Collected from Payanoor Archaeological Site, Tamil Nadu** (ICHLERA11-06)	JC3
04:30 pm – 05:00 pm	**Closing Ceremony** Closing Remarks by **Professor Mayeen Uddin Khandaker**, Chairman of ICHLERA-11, Sunway University Closing Remarks by **Distinguished Professor Mohamed Kheireddine Aroua**, Head of Research Centre for Carbon Dioxide Capture and Utilisation, Sunway University Closing Remarks by **Prof. Ir. Denny Ng Kok Sum**, Dean of School Engineering and Technology, Sunway University	JC3
END OF DAY 3		

POSTER PRESENTATION DAY 3

TIME	POSTER DETAILS	VENUE
09:00 am – 05:00 pm	**ICHLERA11 – 44** *Mr. Mehdi Hassanpour Choubeh Sani* *Space Science Centre (ANGKASA), Institute of Climate Change (IPI), Universiti Kebangsaan Malaysia, Malaysia* **PGNAA Analysis of Sediments from Garab Hot Spring in Behbahan, Iran and Assessment of Radiation Hazards of Present Radioactive Elements**	Poster Display Area, JC3
	ICHLERA11 – 59 *Dr. Siti Rozaila Binti Zahariman* *School of Engineering and Technology, Sunway University, 47500 Bandar Sunway, Selangor, Malaysia* **Natural Radioactivity and Ingestion Dose Due to the Consumption of Popular Instant Noodle Brands in Malaysia**	
	ICHLERA11 – 60 *Dr. Siti Nurasiah binti Mat Nawi* *School of Engineering and Technology, Sunway University, 47500 Bandar Sunway, Selangor, Malaysia* **Impact of BaO and CaO on the radiation shielding properties of BaO-Na_2O-Al_2O_3-B_2O_3-CaO glass systems**	
	ICHLERA11 – 63 *Dr. Yahaya Saadu Itas* *School of Engineering and Technology, Sunway University, 47500 Bandar Sunway, Selangor, Malaysia* **Investigations on Gamma Ray Shielding Parameters of Zinc Boro-Aluminosilicate Glass**	
	ICHLERA11 – 64 *Dr. Sabina Yasmin* *Department of Space Science Centre (ANGKASA), Faculty Institute of Climate Change, University Kebangsaan Malaysia, 43600 UKM, Bangi, Selangor, Malaysia* **Design and evaluation of borate glasses doped with Multiple components for effective low-energy radiation shielding**	
	ICHLERA11 – 65 *Dr. Hassan Salah Ibrahim* *Inaya Medical College, Riyadh, Saudi Arabia* **Assessment of annual occupational dose for dentists and nurses at three dental radiology departments in Saudi Arabia**	

	ICHLERA11 – 66 *Ms. Noor Zati Hani Binti Abu Hanifah* *Department Physics, Universiti Teknologi Malaysia, Skudai, Johor* **Radiation Dose Assessment on Consumer Products Containing Naturally Occurring Radioactive Materials in Malaysia**	
	ICHLERA11 – 68 *Dr. Mohammed Alruwaili* *King Faisal Specialist Hospital and Research center, Saudi Arabia* **The Impact of High Specific Activity Radioactive Iodine (I-131) on Hyperthyroidism Response Rate**	
	ICHLERA11 – 69 *Professor Khalid Alzimami* *Department of Radiological Sciences, College of Applied Medical Sciences, King Saud Bin Abdulaziz University for Health Sciences, Saudi Arabia* **Evaluation of radiation exposure and projected effects from Cardiac Interventional Procedures**	
	ICHLERA11 – 70 *Professor Abdelmoneim Adam Sulieman* *Radiology Sciences Department, College of Applied Medical Sciences- Al-Ahsa, King Saud bin Abdulaziz University for Health Sciences* **Assessment of occupational exposure and Safety for Customs and Border Protection Personnel in Saudi Arabia**	
	ICHLERA11 – 71 *Professor Mohamed Alkhorayef* *Department of Radiological Sciences, College of Applied Medical Sciences, King Saud University, P.O Box 10219 Riyadh, 11433, Saudi Arabia* **Radiation Dosimetry and Radiological Risk Assessment for Orthopedic Department Personnel during Surgeries**	
	ICHLERA11 – 72 *Mohamed Abdulsattar Al-Balushi* *Department of Physics, Faculty of Science, Universiti Malaya, Malaysia* **Characterization of Metallic Oxide Nanomaterials Thin Film for Radiation Shielding Applications**	
	ICHLERA11 – 73 *Dr. Izdihar Binti Kamal* *Dept. of Physics, Faculty of Science, University Putra Malaysia, Malaysia*	

	Vertical Miscentering and Effect on Radiation Dose To The Lens In Computed Tomography Head Examination: A Systematic Review	
END OF DAY 3		

PLENARY SPEAKERS

YBrs. Puan Hajah Noraishah Binti Pungut

Director General
Department of Atomic Energy
Ministry of Science, Technology and Innovation
Malaysia

Hajah Noraishah binti Pungut first joined the Department of Atomic Energy (Atom Malaysia) in 1991 as Assistant Director. Currently, she is the Director General of Atom Malaysia. She received her Bachelor of Nuclear Science (Honours) degree from National University of Malaysia (UKM) in 1991 and her Master's in Environmental Management from UKM in 2006.

With over 31 years of experience in nuclear regulatory matters and the 3'S (Nuclear Safety, Nuclear Security and Nuclear Safeguards). Appointed as Executive Secretary of the Atomic Energy Licensing Board (AELB) in 2022. Appointed as the Chairman of the Radiation Safety Sub-Standing Committee and Standing Committee on Radiation Safety in Atom Malaysia. Member of ASEAN Network of Regulatory Bodies on Atomic Energy (ASEANTOM). Joined Malaysian Radiation Protection Association (MARPA) since 2012.

The Department of Atomic Energy (Atom Malaysia) is a competent regulatory body responsible to control and supervise the use of atomic energy in Malaysia. Atom Malaysia's main task is to enforce the Atomic Energy Licensing Act 1984 (Act 304) and subsidiary legislations. For the past 31 years, she has been working in the various divisions such as Policy and External Affairs Division, Assessment and Licensing Division, Radiation Regulatory Division, Nuclear Installation Division as well as Technical Support Division. Work done such as assessment of the license application, review the radiological impact assessment (RIA) report, drafting regulatory document, code of practice, standards, regulations relating to the atomic energy usage in Malaysia, oversight and regulate safety, security and safeguards of nuclear research reactor, carried out inspection and enforcement activities, radiological and nuclear emergency preparedness and response. Involved in Naturally Occurring Radioactive Materials (NORM) waste management and National Nuclear Security Support and Training Center (NSSC). Previously, she was appointed as the Management Representative of the Integrated Management System of the Atom Malaysia.

Advancing Radiation Protection for Safety Culture

Noraishah[1,*], Ridha[1,*], Erma Hafiza[1,*]

[1]*Department of Atomic Energy, 43800 Dengkil, Selangor, Malaysia*

Corresponding author's email address: noraishah@aelb.gov.my, ridha@aelb.gov.my, ermahafiza@aelb.gov.my

Abstract:

The Department of Atomic Energy (Atom Malaysia) was established under Section 5 of the Atomic Energy Licensing Act 1984 (Act 304). The main objective is to control and supervise any activities involving atomic energy in Malaysia to ensure they are conducted safely without causing any damage to the workers, public, properties and the environment. The applications of ionizing radiation in various fields in Malaysia have grown rapidly since 1968. Currently, 1,841 licensees and 13,728 radiation workers are registered with the Department of Atomic Energy. Most of the radiation workers are working with radiation in various practices or activities such as irradiation facilities, industrial radiography, gauges, research reactors, sales, Naturally Occurring Radioactive Materials (NORM), research institutions, education, medical and etc. Based on our records, dose of radiation workers engaged in industrial radiography is slightly higher compared to other activities. In this conference, key issues revolving around safety culture, enculturating and essential elements of safety culture as well as cultivating safety culture in advancing radiation protection will be explained further.

Keywords: Radiation Protection, Safety Culture, Radiation Worker

Professor Mehdi Sohrabi

Professor of Health and Medical Physics
National Distinguished Professor
Faculty of Energy Engineering and Physics
Amirkabir University of Technology
Iran

Professor Mehdi Sohrabi is a nationally distinguished professor and a member of the Iranian Academy of Sciences. His academic qualifications include a BSc and MSc in Physics from the University of Tehran, an MSc in Health Physics from the University of Tennessee and ORNL, and a PhD in Nuclear Engineering (1975) with a thesis supervised by the late Prof. Karl Z. Morgan at Georgia Institute of Technology, where he was awarded three USERDA projects for his doctoral research. Simultaneously, he served as a Research Scientist and Principal Investigator for USERDA Projects until 1976 at Georgia Tech.

Prof. Sohrabi has over 50 years of experience in education, training, research, development, and services related to radiation protection across the USA, IAEA, Iran, and other countries, beginning in 1965 as the first reactor health physicist. He is an IAEA International Expert, having conducted over 100 expert missions and served as the Regional Radiation Protection Manager for Asia and the Pacific in Vienna, where he helped develop and enhance national radiation protection infrastructures and laboratories. He also held significant roles at the Atomic Energy Organization of Iran, including Professor and Head of the Radiation Dosimetry Division and Professor and Director General of the National Radiation Protection Department, where he established Iran's national radiation protection regulatory program.

Prof. Sohrabi has authored over 200 journal articles and made over 130 invited or oral conference presentations. He has organized and led more than 10 international conferences and over 20 regional meetings. He supervised over 100 MSc and PhD theses, and contributed as an IAEA expert and lecturer for nearly 30 years at over 100 specialized events.His recent research includes innovative hypotheses and discoveries published in Nature Scientific Reports, such as a "Universal Radiation Protection System" (RPD), advancements in photoneutron spectrometry, and novel dosimetry methods. Prof. Sohrabi has received numerous awards, including honorary citizenship from Tennessee, the Monie A. Ferst Memorial PhD Research Award, the 2005 Nobel Peace Prize shared with the IAEA, and several distinguished service and academic awards from Iran and international institutions.

State-of-the-Art Advances on Novel Universal Radiation Protection System

Mehdi Sohrabi, Ph.D.

Senior Professor of Health and Medical Physics, Member of Iranian Academy of Sciences, IAEA former Regional RP Manager and International Expert, Health Physics and Dosimetry Research Laboratory, Department of Energy Engineering and Physics, Amirkabir University of Technology, Tehran, Iran

** Corresponding author's email address: dr_msohrabi@yahoo.com*

Abstract:

From lessons learned and experiences gained for few decades, humankind has always been exposed to natural background (NBG) radiation and sometimes high NBR exposure which make significant contribution to individual exposures. However, such existing exposure situations have not yet been considered in ICRP dose limitation system (1). In particular, for estimating the epidemiological risks of ionizing radiation, the ICRP still applies linear no-threshold (LNT) model which is strongly criticized by experts who propose alternative models such as "Hormesis Model", "Threshold Model" and "URPS Model". Expert debates have found no convincing evidence to support either LNT, Hormesis or Threshold Models. In order to address existing drawbacks in radiation protection, Sohrabi in 2014 theorized a novel Universal Radiation Protection System (URPS) applying a Standardized Integrated Dose System (SIDS) which includes natural radiation exposures to standardize dose limitation system and individual doses for regulatory control worldwide (2). Since 2014, a number of novel fundamental concepts such as URPS Model, exposure fractionation, etc. have been developed for the first time in this study based on which we have now an advanced URPS fulfilling present radiation protection drawbacks worldwide: It is ready for any debate, acceptance and implementation in the 21st century (3-11). In this paper, the state-of-the-art development fulfilling requirements of the novel URPS have been developed and discussed in comparison with those of ICRP System.

References:

[1]. International Commission on Radiological Protection. The 2007 recommendations of the international commission on radiological protection. Publication 103, Ann. ICRP 37(2–4), Elsevier (2007).
[2]. Sohrabi, M., "A Universal Radiation Protection System (URPS) based on Individual Standardized Integrated Doses. Radiat. Prot. Dosimetry.64(4), pp.459-66 (2015).
[3]. Sohrabi, M., "Universal Radiation Protection System (URPS); A Natural Global Standardized Trend for Human Exposure Control in 21th Century", Radiat. Prot. Dosimetry. May (2019), doi:10.1093/rpd/ncz097.
[4]. Sohrabi, M., "The URPS for Universal Radiation Protection Standardization", 14th International Congress of IRPA, Cape Town, South Africa, 9-13 May (2016) (Invited Talk).
[5]. Sohrabi, M., "On Dose Reconstruction for the Million Worker Study: Status and Guidelines", Health Phys. 109, 327-329 (2015).
[6]. Sohrabi, M., Editorial, "A Standardized Individual Dose System for Epidemiology of Public and Workers by Universal Radiation Protection System Hypothesis". J. Epidemiol. Public Health Rev. 1(3) (2016).
[7]. Sohrabi, M., Editorial, "Dose Fractionation Concept in Radiation Protection to Standardize Risk/Dose Limits and Epidemiology Studies", J. Epidemiol. Public Health Rev. 2(4) (2017).
[8]. Sohrabi, M., Editorial, "Conservation of "Cause-effect" by using Integrated Individual Radiation Doses towards Standardization of Epidemiology Health Risk Estimates of Nuclear/Radiation Workers", J. Nucl. Ene. Sci. Power Generat. Technol. 6:2 (2017).
[9]. Sohrabi, M., "Bridging the LNT and Hormesis Radiation Protection Models", Nuclear News, pp.37-42, June (2018).
[10]. Sohrabi, M. Eyes Should be Washed for Global Change in Radiation Protection of 21st Century. Health Physics 120 (4), 455-458) (2021).
[11]. M. Sohrabi. Modern universal standardized trends in worker and public exposure monitoring and control in 21st century by Sohrabi URPS-based hypothesis. Radiation Protection Dosimetry 1–9 (2023).

INVITED SPEAKERS

Professor David A. Bradley

Distinguished Professor
Applied Physics and Radiation Technologies Group
CCDCU, Sunway University
Malaysia

Professor David A. Bradley is a Distinguished Research Professor in the Applied Physics and Radiation Technologies Group at the Centre for Chemical and Data Science (CCDCU) at Sunway University. He is also a Professor Emeritus at the Centre for Nuclear and Radiation Physics in the Department of Physics at the University of Surrey and holds an Honorary Professorship at University College London (UCL).

Professor Bradley earned his PhD from USM, his MSc from London, and his BSc from Essex. He is a Fellow of the Institute of Physics (F.Inst P.) and the Institute of Physics and Engineering in Medicine (FIPEM). He previously served as the Head of the Centre for Applied Physics and Radiation Technologies at Sunway University. His notable roles include serving as Secretary and Immediate Past-President of the International Radiation Physics Society (IRPS) and holding editorial positions with several prominent journals, including the British Journal of Radiology, Applied Radiation and Isotopes, and Radiation Physics and Chemistry.

While Professor Bradley's early work focused on the fundamental aspects of radiation interactions, he has increasingly applied his expertise to biomedical and industrial applications. His contributions include the development of luminescence dosimeters, which led to the establishment of two companies: TrueInvivo in the UK and Lumisyns in Malaysia. He has supervised 35 PhD students, resulting in extensive collaborations, approximately 13,000 citations, and an h-index of 56.

A Forward-Looking Perspective on Exposures, Dosimetry and Applications

D.A. Bradley[1,2,*]

[1]*Applied Physics and Radiation Technologies Group, CCDCU, Sunway University, Malaysia*
[2]*School of Mathematics and Physics, University of Surrey, Guildford, United Kingdom*

** Corresponding author's email address: d.a.bradley@surrey.ac.uk, dbradley@sunway.edu.my*

Abstract:

We examine a number of challenging low dose, low dose rate measurement situations, with values from as low as a few μGy per hour through to mammographic doses delivered over sub-seconds to in excess of one second. In the former case our interests include measurements of naturally occurring radioactive material (NORM) arising from the technological operations of oil and gas extraction, including the difficulties of detecting the beta emitter ^{210}Pb, most specifically in hard to access locations such as the internal aspects of scaled tubulars. Here we record our development of a hand-held fibre optic system, with applications noted for this in NORM as well as other situations such as detection of orphaned anthropomorphic sources. We have further sought to obtain age evaluations of books published from 1700 CE through to 1900 CE, conducted via indirect measurement of natural background dose deposition in print ink using Raman spectroscopy. Here an association is to be noted with Wigner energy, albeit predominantly using low LET sources. In regard to the mammographic imaging applications we focus on skin dose, use being made of 50 μm high purity graphite foils and 75 μm PTFE tape, investigating the potential of these in evaluation of dose in dermal and epithelial layers. For this, with x-rays generated in the 25- to 30 kVp range, the produced energetic electrons have a range of ~7 μm, indicating that dose assessment can be had from depths in skin down to as little as 7 μm. For the graphite foils we have measured the thermoluminescence yield, while for the PTFE we have used Raman spectrometry and photoluminescence. The efforts support the ICRU recommendation that skin dose be assessed at a skin depth 0.07 mm, equating to the uniquely mitotically active dermal layer responsible for the replenishment of skin cells. Support for the results of our measurements in both mammography and NORM have been sought from Monte Carlo simulations using the TOPAS code. Finally, it is to be noted that these developments, including further implications, have clearly resulted from large collaborative efforts, all to be acknowledged during the course of the talk.

Professor Ir. Dr. Hairul Azhar Abdul Rashid

Vice President
Market Exploration, Engagement and Touchpoints (MEET)
Multimedia University, Cyberjaya
Malaysia

Professor Ir. Dr. Hairul Azhar Abdul Rashid serves as the Vice President of Market Exploration, Engagement, and Touchpoints (MEET) at Multimedia University, Cyberjaya. He is also a Professor at the Fiber Optics Research Center within the Faculty of Engineering at the same institution, where he specializes in optical fiber devices and sensors.

He earned his PhD in Optical Communication Systems from Multimedia University in 2007. Since then, he has led a research team working with Telekom Research and Development Sdn. Bhd. (TMR&D) on the design and production of specialty optical fibers for communication and sensing applications. His research team has secured nearly RM9.9 million in grants from PETRONAS, MOSTI, MOE, and TM. They are particularly focused on developing doped optical fibers for use as radiation dosimeters. His research efforts have resulted in 156 peer-reviewed journal articles and 78 conference papers. Additionally, he has filed 2 patents and been granted 6 Industrial Designs (ID). His team has established extensive collaborations both within Malaysia and internationally, engaging with various academic and industrial partners.

Development of Radiation Survey Meter with Extendable Optical Fiber Probe

H.T. Zubair[1,2], M. Nadzim A. Ghani[2], R. Rifiat[3], Adebiyi Oresegun[1], F. Hamidi[3], J. Othman[3], M.D. Khairina[2], A. Basaif[1], S. A. Ibrahim[1], H. A. Abdul-Rashid[1*] and D.A. Bradley[4,5]

[1]*Fibre Optics Research Centre, Faculty of Engineering, Multimedia University, Jalan Multimedia 63100 Cyberjaya, Malaysia.*
[2]*Lumisyns Sdn Bhd, 47600 Subang Jaya, Selangor, Malaysia.*
[3]*Alypz Sdn Bhd, Jalan Industri USJ 1/1, Taman Perindustrian USJ 1, 47600 Subang Jaya, Selangor, Malaysia.*
[4]*Applied Physics and Radiation Technologies Group, CCDCU, Sunway University, Malaysia.*
[5]*School of Mathematics and Physics, University of Surrey, Guildford, GU2 7XH, UK.*

** Corresponding author's email address: hairul@mmu.edu.my*

Abstract:

This paper presents the development and field validation of a novel radiation survey meter equipped with an extendable optical fiber probe. This innovative device addresses the need for remote measurement and monitoring of radioactive contamination, particularly in challenging environments such as oil and gas exploration and metal processing industries.

Problem Statement:
In the oil exploration and mining sector, there are significant challenges associated with the decommissioning of tubulars, which can range from 50,000 to 200,000 units requiring assessment for radioactive contamination. Traditional handheld devices necessitate proximity to the radiation source, posing risks to operators. Additionally, the scrap metal and metal processing industries have reported incidents of raw materials emitting radiation at levels far exceeding occupational safety limits. These contaminants, notably Cobalt-60, can persist in finished goods, posing ongoing risks.

Existing Solutions:
Current market solutions are predominantly handheld devices, with some high-end models featuring extendable probes. However, these still require the operator to be near the radiation source, limiting their effectiveness and safety. The cost of these devices ranges from MYR 10,000 to 60,000, making widespread deployment challenging.

Proposed Solution:
The proposed radiation survey meter integrates a handheld unit with an extendable optical fiber probe up to 10 meters, equipped with a scintillator detector. This battery-operated device provides remote measurement capabilities, significantly enhancing operator safety and measurement flexibility. It features an alarm signal for immediate detection and response.

Results and Discussion:
Field trials were conducted at the Kemaman Supply Base decontamination facility, where the prototype was tested alongside reference survey meters. These trials, supported by the Public-Private Research Network (PPRN) grant, demonstrated the efficacy of the device in detecting Naturally Occurring Radioactive Materials (NORM) in components from offshore facilities. The fiber optic probe showed a consistent linear response in µSv/hr units when compared with reference meters, confirming its reliability. Further, the device's performance remained stable during prolonged operation, with measurements maintaining an average value around 1500 counts per minute (CPM). These results validate the prototype at Technology Readiness Level 5 (TRL-5), indicating successful testing in real-world environments.

Conclusion:
The development of this extendable optical fiber probe radiation survey meter represents a significant advancement in remote radiation monitoring technology. It provides a safer, more flexible solution for detecting radioactive contamination in industries where traditional handheld devices fall short. Future work will focus on further refinement and commercial scaling of the device to enhance its accessibility and utility across various sectors.

Keywords: Radiation Survey Meter, Optical Fiber Probe, Remote Measurement, NORM, Radiation Safety, Field Trials, Oil and Gas Industry, Metal Processing Industries

Professor Shinji Tokonami

Director
Institute of Radiation Emergency Medicine
Hirosaki University
Japan

Professor Shinji Tokonami serves as the Director of the Institute of Radiation Emergency Medicine at Hirosaki University in Japan. He is a full professor in the Department of Radiation Physics at Hirosaki University, specializing in radiation measurements and dose assessment. He earned his Ph.D. in engineering from Waseda University in 1995. He has a distinguished career in radiation research, having worked at Waseda University, the National Institute of Radiological Sciences, and Hirosaki University.

Professor Shinji Tokonami is actively involved in international committees related to radon and radiation measurements and currently serves as an executive director of the Japan Health Physics Society. Dr. Tokonami has developed several innovative measurement techniques and instruments. Notably, he created a specialized algorithm for measuring airborne radon decay products through continuous air sampling and established a passive technique for separately measuring two radon isotopes, radon-222 and radon-220. This technique led to the issuance of ISO 16641 as an international standard. In response to the Fukushima nuclear accident, he is working on rapid and effective methods for measuring thyroid radioactivity to assess doses and quantify radiological impacts from nuclear incidents.

An Experimental Review of ICRP Lung Model for Radon/Thoron Progeny Inhalation

Shinji Tokonami

Institute of Radiation Emergeny Medicine, Hirosaki University

** Corresponding author's email address: tokonami@hirosaki-u.ac.jp*

Abstract:

The dose conversion factor (DCF) for radon/thoron progeny has recently been updated based on the latest dosimetric approach. The DCF value was larger than that provided by UNSCEAR by a factor of 2. If a new DCF is introduced for the radiological protection on occupational exposures, dose mitigation will be further required. Therefore, the new DCF needs to be reviewed for the validation.
In the present study, an experimental review was attempted from the following three physical parameters:

1) Morphological characteristics of the respiratory tract
2) Hygroscopic growth of aerosols in the respiratory tract
3) Particle size distribution of radon/thoron progeny aerosols

1) Morphological characteristics of the respiratory tract

The International Commission on Radiological Protection (ICRP) proposed the Human Respiratory Tract Model (HRTM) for dose assessment due to inhalation of airborne radioactive aerosols in Publication 66. The morphological characteristics of the HRTM were developed based on only several dozen Caucasian males. However, a dosimetric model for the respiratory tract should be applicable to all ethnic groups. Therefore, we have examined whether the HRTM is sufficient to assess radiation doses for Asian populations (public and workers) or not. In this subject, we evaluated the morphological characteristics of the respiratory tract using X-ray computed tomography (X-CT) to construct the HRTM for Asian populations. To the best of our knowledge, this will be the first approach to use X-CT imaging for the development of the HRTM for radiation protection.

2) Hygroscopic growth of aerosols in the respiratory tract

The ICRP mentioned the importance of aerosol size distribution in internal dose assessment because the deposition location in the respiratory tract depends on aerosol size. Aerosols grow in particle size under high humidity conditions; this phenomenon is known as hygroscopic growth and is quantified by the hygroscopic growth factor (*hgf*). The ICRP adopted a *hgf* value of 2.0 for indoor workplaces to accurately assess the
internal dose. However, this *hgf* value is an assumed value obtained from a few experimental data points, which may be uncertain; therefore, we have set up an experimental system to measure aerosol particle sizes at different humidity levels and evaluated the value of *hgf*.

3) Particle size distribution of radon/thoron progeny aerosols

The dose given by the inhaled radon progeny depends on its size distribution. For determining the dose coefficients, the ICRP Publ. 137 assumes a trimodal distribution with activity median diameters (AMDs) of 1 nm with geometric standard deviations (σg) of 1.3, and 30 nm and 250 nm with σg of 2.0 for indoor work environments. Also, a bimodal distribution with AMD of 1 nm and 250 nm with the same geometric standard deviations as those in indoor for mines and tourist caves were assumed. Generally, the size distribution of aerosols is different between natural and artificial origin of them. It is required to determine the range of dose coefficients for specific places. In this subject, aerosol size distributions were measured and site-specific dose coefficients were evaluated in various environment.

Professor Jojo Panakal John

Head of Biomedical Engineering Section
Papua New Guinea University of Technology
Papua New Guinea

Professor Jojo Panakal John is a Professor at the School of Applied Physics and the Head of the Biomedical Engineering Section at the Papua New Guinea University of Technology in Lae, PNG. Before this role, he served as a visiting faculty member at University Malaya and as Principal and Professor at Fatima Mata National College (Autonomous) in India. With over 30 years of experience in university teaching and research, he holds an MPhil and PhD in Applied Nuclear Physics from Aligarh Muslim University, India.

His primary research interests are in radiation dosimetry and its health effects. Professor John has authored more than 100 peer-reviewed journal articles and 93 conference papers. He has supervised 15 PhD students, 4 MPhil students, and numerous graduate and postgraduate students. He has led over a dozen funded research projects both in India and internationally. His research has explored the health effects of radiation, including chromosomal aberrations and congenital malformations in areas with high background radiation.

Living with Radiation: A comparative Health Impact Evaluation in High Background Radiation Area in India with Normal Regions in PNG

Jojo Panakal John

School of Applied Physics, Papua New Guinea University of Technology, Lae, Morobe Province, Papua New Guinea

Corresponding author's email address: panakal.jojo@pnguot.ac.pg

Abstract:

Exposure to natural environmental radiation is continuous and unavoidable but generally occurs at low levels. However, prolonged exposure, to high level of radiation, can pose health risks. In several regions on Earth, the natural radiation levels are strangely high. The radiation in such areas originates from naturally occurring radioactive materials such as uranium, thorium, radon and thoron gas in the surface soil. Limiting exposure to hazardous materials and mitigation is a primary step in reducing health concerns of the public. Radon, thoron and their progeny are known potential indoor air pollutants causing higher risk of lung cancer through chronic exposure. Even at low concentrations, extended exposure to radon and progeny can result in increase in the risk of lung cancer. The coastal regions southern coast of Kerala, in India, have high natural background radiation due to thorium-rich monazite sand available in great abundance in the beach sand. It is argued that high level of radiation in the region causes higher ingestion of radionuclides through air, water and food causing higher exposure resulting in malignancy. Incidences of congenital malformations like mental retardation, cleft palate, and cleft lip found in the region are frequently attributed to the high background radiation prevailing in the area. There are pieces of evidence suggesting increased rates of chromosomal aberrations which can occur due to exposure to ionizing radiation. Epidemiological studies have struggled to demonstrate a clear increase in health effects from low background radiation levels. On the contrary, beneficial effects of differences in cellular regulation process were observed in individuals suggesting adaptation to the high background radiation. The present study makes an attempt to compare the natural ambient radiation levels in the high background radiation area in India with that prevails in the city of Lae, in Papua New Guinea. The marked difference in radiation levels between high and normal regions provides a unique opportunity to study the long-term health effects of low-dose radiation exposure, as well as the potential genetic and biological adaptations in populations residing in these high-radiation environments.

Professor Dr. Suhairul Bin Hashim

Physics Department, Faculty of Science
Universiti Teknologi Malaysia
Malaysia

Professor Dr. Suhairul Bin Hashim earned his B.Sc. (Hons) in Nuclear Science from Universiti Kebangsaan Malaysia in 2001, an M.Sc. in Medical Physics from the University of Surrey in 2005, and a Ph.D. from Universiti Teknologi Malaysia (UTM) in 2009. After completing his Ph.D., he undertook a Research/Postdoctoral Fellowship at the Centre for Nuclear and Radiation Physics at the University of Surrey, supported by Kansas State University and UTM. He subsequently worked as a physicist at the Oncology Centre, Sultan Ismail Hospital, from July 2013 to June 2014.

Professor Suhairul is currently a Professor in the Physics Department at UTM. Hehas an h-index of 29, with 2,725 citations across 192 publications, including 156 international journal articles, 3 book chapters, 1 book, and 1 encyclopedia entry on Medical Physics. He has reviewed over 100 papers for international journals, mainly in Q1 and Q2 journals such as Journal of Alloys and Compounds and Radiation Physics and Chemistry. He was a member of the Editorial Board of Heliyon from May 2015 to June 2019 and is now an Associate Editor for Nuclear/Medical Physics at Heliyon Physics. He has served as an Affiliate Member of the Young Scientists Network - Academy of Sciences Malaysia (YSN-ASM), which coordinates efforts to advance the national science and technology agenda. In 2020, he received the Top Research Scientist Malaysia award from the Academy of Sciences Malaysia, recognizing his outstanding contributions to nuclear science and technology, TL/OSL dosimetry, radiation dosimeters, and material science over the past 15 years. Professor Suhairul has delivered keynote and invited talks in Iraq, Saudi Arabia, Sunway University, UiTM, the Ministry of Health, the Malaysia Atomic Energy Licensing Board, and the Malaysia Nuclear Agency. He is a member of the Nuclear and Radiation Physics Research Group within the Resource Sustainability Research Alliance at UTM. His professional affiliations include the International Society of Radiation Physics (ISRP), Health Physics Society (HPS), Institute of Physics (IOP), IEEE Nuclear and Plasma Sciences Society, Malaysian Solid State Science and Technology Society (MASS), Institut Fizik Malaysia (Malaysian Institute of Physics), Malaysian Nuclear Society (MNS), and Malaysian Association of Medical Physics (MAMP).

.

Radiological and Elemental Analysis of Indoor Tiles in Malaysia: Implications for Public Health

Azlina Baha[a,b], S. Hashim[a,c,*], M.S.M. Sanusi[a], Halmat J. Hassan[d] & Engku Mohd Fahmi Engku Chik[e]

[a]*Department of Physics, Faculty of Science, Universiti Teknologi Malaysia, Johor 81310, Malaysia.*
[b]*Department of Physics and Material Science, Faculty of Applied Science, Universiti Teknologi MARA (UiTM), Cawangan Negeri Sembilan, Kampus Kuala Pilah, Pekan Parit Tinggi, 72000 Kuala Pilah, Negeri Sembilan.*
[c]*Ibnu Sina Institute for Scientific and Industrial Research (ISISIR), Universiti Teknologi Malaysia, Johor 81310, Malaysia.*
[d]*Department of Physics, College of Education, University of Sulaimani, Sulaimani, 46001, Kurdistan, Iraq.*
[e]*Kumpulan Aplikasi Penyurih Alam Sekitar (e-TAG), Bahagian Teknologi Sisa dan Alam Sekitar (BAS), Agensi Nuklear Malaysia, Bangi, 43000 Kajang, Selangor.*

** Corresponding author's email address*: *suhairul@utm.my; Tel.: +60-13-7564706*

Abstract:

Various building materials contain radioactive elements and are widely available in the market. Although radiation exposure from naturally occurring radioactive materials (NORMs) in building materials is categorized under an existing exposure situation to members of the public and is generally unavoidable, the radioactivity content and resulting doses can vary significantly. This depends on the geological origin of any natural materials used in the production of building materials. In this study, the radioactivity concentration of ^{238}U, ^{232}Th and ^{40}K and associated radiological hazard indices in commonly used tile products was measured using HPGe gamma spectroscopy. A total of 30 samples of commercial tiles were used, including glazed and unglazed ceramic, porcelain, and advanced technology tiles with nano-polished surfaces and negative-ion properties. The study found that the range activity concentration of ^{238}U, ^{232}Th and ^{40}K in samples were from 46.22 ± 9.37 to 316.02 ± 61.51, 33.79 ± 6.46 to 200.84 ± 36.88 and 500.37 ± 89.01 to 1059.00 ± 188.01 Bq kg^{-1} respectively. The mean values for *Raeq*, *Hex*, and *Iα* in building materials are 365.52 Bq kg^{-1}, 0.99, and 0.74, respectively, below the recommended safe limits of 370 Bq kg^{-1} and 1. Similarly, the mean I_γ value of 1.30 is within the safe limit of 2 for superficial materials. The lifetime risk of cancer incidence and mortality, element composition and mapping of the tiles, and the equivalent dose for an adult human organ were also discussed. It can be concluded that Malaysians face minimal radiation risk using these 30 tiles. Overall, the collected data offers a novel baseline for radiological information, estimating long-term health risks from radioactivity in these materials. Additionally, this valuable information can contribute to the development of guidelines for monitoring materials in the building construction industry, specifically for Malaysia.

Keywords: tiles; HPGe gamma spectrometer; radiological risk analysis; elemental analysis; dosimetric organ equivalent

Dr. Husaini Bin Salleh

President
Malaysian Radiation Protection Association (MARPA)
Malaysia

Dr. Husaini Bin Salleh is the President of the Malaysian Radiation Protection Association (MARPA) for the 2022-2024 term. In addition to this role, he holds several significant positions, including Director of the Radiation Safety & Health Division, Emergency Director for the SHE Committee, and Radiation Protection Officer for the Malaysian Nuclear Agency. He also acts as a Medical Physics Consultant for the H Class License issued by the Ministry of Health Malaysia and serves as Chairman of Agensi Nuklear Malaysia AKRAB.

Dr. Salleh's expertise extends across various domains. He provides expert consultation on radiation protection and safety for both medical and non-medical sectors. He manages dosimetry and metrology operations at the Medical Physics Laboratory (MPL) and the Secondary Standard Dosimetry Laboratory (SSDL), both of which are accredited under MS ISO 17025. As a distinguished lecturer and speaker in radiation protection and safety, Dr. Salleh has been involved in key engagements, including lecturing for the IAEA-PGEC program on medical physics, participating in the IAEA Expert Mission to Oman from October 6-10, 2019, speaking at the ICORP 2022 in Geneva from September 5-9, 2022, and joining the IAEA Expert Mission to Laos from May 15-19, 2023.

Living With Radiation: Something That We Should Know

Husaini Salleh

Malaysian Radiation Protection Association (MARPA)

** Corresponding author's email address*: *husaini@nm.gov.my*

Abstract:

Radiation is a natural part of our world, but high doses can pose health risks. This topic explores what it means to live with radiation exposure, both natural and man-made. It will cover the different types of radiation and how they affect us. Learn about the amount of radiation we encounter daily and how to distinguish between safe levels and harmful exposure. The discussion on how radiation is used in medical practices, industries, research activities and the safety precautions taken during these procedures. Finally, it will touch on ways to minimize radiation risk in everyday life.

Keywords: background radiation, types of radiation, ionizing, non-ionizing radiation

Dr. A. Chandrasekaran

Assistant Professor
Department of Physics
SSN College of Engineering
India

Dr. A. Chandrasekaran serves as an Assistant Professor in the Department of Physics at Sri Sivasubramaniya Nadar College of Engineering in Chennai, India. With over 15 years of experience in college-level teaching, he specializes in Environmental Radiation and Molecular Spectroscopy.

Dr. Chandrasekaran earned his Ph.D. in these fields and has received notable accolades, including the Best Lecturer Award for exceptional academic performance during the 2012-2013 academic year at the Global Institute of Engineering & Technology, Vellore, Tamil Nadu. He conducts research in collaboration with the Indira Gandhi Centre for Atomic Research (IGCAR) in Kalpakkam and has been recognized for his contributions with several awards, including Best Paper Awards at the 19th National Symposium on Radiation Physics (NSRP-19) in 2012 and the International Conference on Radiation Biology (ICRB-16) in 2016. Dr. Chandrasekaran has published over 80 conference papers and more than 120 peer-reviewed journal articles. He has delivered invited talks at various conferences, including presenting a paper on "Radioactivity and Cancer Risk Assessment" at the Fourth Asian and Oceanic Congress on Radiation Protection, IRPA, in Kuala Lumpur, Malaysia, in 2014. He was honored with the Young Scientist Award by the Venus International Research Foundation in 2018 and the Pearasiyar Kalimani Viruthu-2019 by the Kaviyarsar Kalai Tamilsangam, Nammakal.

Additionally, Dr. Chandrasekaran is the author of an engineering physics textbook published by Sci-tech and Vedha Publications in Tamil Nadu and is a lifetime member of the Society for Radiation Research, India. He has supervised one PhD student to completion and currently guides four others.

Radioactivity Measurement in beach sediments, soil, building materials, and fertilizers collected from Tamil Nadu, India

A. Chandrasekaran*

Department of Physics, Sri Sivasubramaniya Nadar College of Engineering (Autonomous), Kalavakkam, Chennai – 603 110

** Corresponding author's email address: chandrasekarana@ssn.edu.in*

Abstract:

This study examines the radioactivity of environmental and commercial materials collected from Tamil Nadu, India, including beach sediments, soil samples, building materials, and fertilizer samples, using a NaI(Tl) detector-based gamma ray spectrometer. The activity concentration (in Bq kg^{-1}) of the radionuclides ^{238}U, ^{232}Th, and ^{40}K and associated radiological parameters were calculated in order to assess the radiological risk to humans. The average activity concentrations for ^{238}U (50), ^{232}Th (32), and ^{40}K (543) in the beach sediments collected from the east coast of Tamil Nadu exceeds the world recommended limit, as well as the mean value of radiological parameters like absorbed dose rate (124 nGy h^{-1}), excess lifetime cancer risk (0.53×10^{-3} $mSvy^{-1}$), and annual gonadal dose equivalent (457 μSv y^{-1}) also exceeded the world recommended limit. Similarly, the mean activity concentration of the ^{40}K for the red and black soils was higher than the world recommended limit, while ^{238}U and ^{232}Th had lower values. The calculated exposure rate (ER), indoor absorbed dose rate (DR_{in}), and indoor excess lifetime cancer risk ($ELCR_{in}$) values of the soil samples were greater than the world average value while outdoor radiological parameters had a lower value. For building material (brick samples), the calculated activity concentration of radionuclides (^{238}U, ^{232}Th, and ^{40}K), absorbed dose rate, DR_{in} (89 nGy h^{-1}), annual effective dose equivalent, $AEDE_{in}$ (0.43×10^{-3} mSv y^{-1}), and excess lifetime cancer risk, $ELCR_{in}$ (1.52 mSv y^{-1}), are slightly greater than the world recommended limit. Likewise, the mean activity of the ^{238}U (177) and ^{40}K (4136) for the fertilizer samples (including single superphosphate, potassium, and ammonium phosphate sulfate) had a greater value than the world recommended limit, while ^{232}Th (5.75) had a negligible amount. The average value of radium equivalent activity, Ra_{eq} (503 Bq kg^{-1}) and absorbed dose rate, D_R (282.93 $nGyh^{-1}$), which is greater than the permissible limit, whereas the annual effective dose rate, AEDR (0.316×10^{-3} $mSvy^{-1}$) has a lower value.

Keywords: Radioactivity; Radiological parameters; Beach sediments; Building materials; Fertilizers; Tamil Nadu

Dr. Huda Al-Sulaiti

Senior Research Director
Natural and Environmental Hazards Observatory,
Qatar Environment and Energy Research Institute (QEERI)
Qatar

Dr. Huda Al-Sulaiti holds a PhD in Radiation and Nuclear Physics and an MSc in Radiation and Environmental Protection from the University of Surrey, UK. As the founding Senior Research Director of QEERI's Natural and Environmental Hazards Observatory, she brings over 30 years of expertise in environmental radioactivity and radiation protection.

Her current research is dedicated to evaluating and mitigating environmental radioactivity and techno-radiological hazards through innovative approaches, aiming to enhance governmental and community resilience and response. At QEERI, Dr. Al-Sulaiti's research involves creating comprehensive baseline data and atlases for radiological contaminants in groundwater and seawater to assess the environmental impacts of regional industrial activities and related health risks. This includes developing detailed digital seawater maps at various depths to establish baselines for contaminants like Cs137, Pu, tritium (H3), and Sr90, which may be influenced by nearby nuclear activities in the Gulf region. Her work also addresses elevated levels of Radon and Radium in groundwater and soil, attributed to the excessive use of phosphate fertilizers.

In collaboration with the Cyprus Institute, Dr. Al-Sulaiti and her team have developed atmospheric dispersion models (FLEXPART-WRF-CHEM) to simulate and forecast the radiological dispersion of I^{131} and Cs^{137} from potential nuclear accidents. This research aims to estimate the activity of Cs^{137} in dry and wet precipitation and the equivalent and effective dose of I^{131} from inhalation.

Environmental Radioactivity Hazards Measuring the Invisible

Dr. Huda Al-Sulaiti

Natural and Environmental Hazards Observatory Center (NEHO)
Qatar Environment and Energy Research Institute (QEERI), Hamad Bin Khalifa University (HBKU)

Corresponding author's email address: halsulaiti@hbku.edu.qa

Abstract:

Radionuclides are present around us, originating from both natural sources and human activities. In the past decade, numerous studies have been conducted to investigate radioactivity in various contexts, particularly focusing on groundwater in industrial and agricultural areas, as well as seawater. This study aims to compare the levels of radioactivity in groundwater wells from industrial and agricultural zones to understand the differing impacts and potential sources of contamination. Public concern often arises regarding the use of groundwater near industrial areas, especially close to oil wells, due to the anticipated impact of industrial activities on water quality. Conversely, groundwater wells in agricultural areas are frequently used in daily life, despite the potential for contamination from agricultural practices, such as the use of phosphate fertilizers containing naturally occurring radioactive materials (NORMs). By analyzing water samples from both environments, this research seeks to elucidate the extent of anthropogenic versus natural contributions to water radioactivity. Seawater radioactivity is also examined to provide a broader context, particularly in coastal regions influenced by runoff from both industrial and agricultural zones. This comparison is crucial for highlighting the varying degrees of environmental contamination and the associated risks to human health and ecosystems. The analysis of radioactivity in different water sources reveals that the results for groundwater in industrial areas are within expected ranges due to the proximity of oil wells, which can naturally elevate radioactivity levels. For instance, groundwater analyzed by KSA Labs shows Ra-226 at 3.27 Bq/L and Rn-222 at 26.25 Bq/L, while NPL Labs reports higher Ra-226 at 20.1 Bq/L, along with Pb-214 at 10.7 Bq/L and Pb-210 at 3.2 Bq/L. These levels are considered normal for industrial areas influenced by nearby oil wells. In contrast, the elevated radioactivity in farming area wells is concerning as there is no apparent source of contamination. The highest Rn-222 concentration among all samples, at 358 Bq/L, suggests significant radon presence, which is unusual and warrants further investigation. The Ra-226 level in these wells is moderate at 4.39 Bq/L, with low Pb-210 at 0.21 Bq/L and noticeable Pb-214 at 4.27 Bq/L. Seawater results are also worrisome and need to be closely monitored. With H-3 (Tritium) at 8.8 Bq/L, K-40 at 22 Bq/L, Pb-210 at 4.8 Bq/L, and Po-210 at 0.156 Bq/L, these levels are slightly lower but comparable to some results found in contaminated areas such as Japan. This raises concerns about potential sources of contamination affecting seawater and underscores the need for ongoing monitoring to ensure environmental safety. In conclusion, this study has provided valuable insights into the levels of radioactivity in groundwater from industrial and agricultural areas, as well as seawater, highlighting both natural and anthropogenic sources of contamination. The results indicate that radioactivity levels in groundwater near industrial sites are generally within expected ranges due to influences from nearby oil wells, whereas elevated levels in agricultural areas suggest potentially unrecognized sources of contamination. The findings underscore the importance of continued monitoring to mitigate risks to human health and ecosystems. Future research should focus on identifying specific sources of radioactivity in agricultural groundwater and implementing strategies to minimize contamination, while also enhancing monitoring efforts in seawater to ensure environmental safety and public health protection.

Ms. Anne Lawai Awan

Chief Operating Officer
Alypz Sdn. Bhd.
Malaysia

Ms. Anne serves as the Chief Operating Officer at Alypz Sdn. Bhd., where she leads the company's operations and drives its vision and strategic direction. She graduated from the National University of Malaysia in 1995 with a Bachelor of Science (Honours) in Chemistry.

She also holds several certifications, including being a Licensed Radiation Protection Consultant with the Atomic Energy Licensing Board (AELB) Malaysia and a certified Environmental Impact Assessment (EIA) Consultant with a specialization in Radiological Impact Assessment and NORM Management. With over 25 years of experience, Anne has been instrumental in delivering radiation protection consulting and training to major oil, gas, and mineral processing companies around the world.

Ms. Anne has managed numerous projects related to the assessment and management of Naturally Occurring Radioactive Materials (NORM) at various international oil and gas sites, including those operated by Petronas Carigali, Total E&P, Shell, ExxonMobil, Murphy Oil, Chevron, and Kuwait Oil Company. Notably, she led four projects for Kuwait Oil Company, focusing on NORM waste management and the disposal of radioactive materials. Additionally, she has performed Radiological Impact Assessments, Radiation Safety Analysis, and Radioactive Balance Analysis for companies such as Lynas Sdn. Bhd. and Space Metal Sdn. Bhd.

Her expertise includes developing NORM Management procedures, Radiation Protection Programs, and radiological emergency preparedness and response plans, as well as integrating these into management systems. Anne's contributions to radiation safety and occupational health have been recognized through her presentations at international conferences, where she has highlighted best practices in radiation safety management, TENORM in the oil and gas industry, and NORM management in mining. Her career reflects a significant commitment to advancing radiation protection practices and safeguarding workers and the environment across various sectors.

NORM Monitoring at Oil and Gas Operations in Malaysia

Anne L. Awan[1], David A Bradley[2,3], Harun.W.Nik[1]

[1]*Alypz Sdn. Bhd, Subang Jaya, Malaysia*
[2] *Applied Physics and Radiation Technologies Group, CCDCU, Sunway University, Malaysia*
[3] *School of Mathematics and Physics, University of Surrey, Guildford, UK*

Corresponding author's email address: anne.l.awan@alypz.com, d.a.bradley@surrey.ac.uk, harun.w.nik@alypz.com

Abstract:

This presentation examines the monitoring of Naturally Occurring Radioactive Materials (NORM) at offshore and onshore installations of oil and gas operations in Malaysia. Monitoring objectives include establishing baseline NORM levels, identifying contaminated facilities, and characterizing waste streams for proper management. Data compiled from multiple operators over operational years reveal insights into NORM levels during routine and specific activities (such as maintenance and workovers).

Monitoring was carried out using a combination of field equipment for in situ assessments and laboratory-based facilities for radioanalytical analysis. The findings indicate that certain facility areas exhibit elevated NORM levels, with the highest recorded radiation exposure reaching 21.2 μSv/hr externally during routine monitoring, and 145.0 μSv/hr internally during specific monitoring. These values greatly exceed the observed average baseline value at the time of 0.13 μSv/hr and regulatory limit of 0.5 μSv/hr. Waste from vessel cleaning activities, specifically sludge and sand, has been classified as NORM waste due to the activity concentration of radionuclide from U-238 and Th-232 series in the waste surpassing the regulatory limit of 1 Bq/g (inclusive background). As a result, there is clear evidence of the need to enforce stringent safety procedures during the handling of NORM waste and NORM-contaminated facilities. These measures are essential to mitigate potential health risks associated with radiation exposure.

The hazards from surface contamination resulting from alpha and beta emitters, as well as radon gas and airborne particulates, are unlikely to exist during routine activities as these hazards are confined to within the facilities. Results obtained during the specific activities however have indicate instances of levels exceeding the regulatory limits.

Overall, this monitoring initiative continues to provide critical data for enhancing safety measures, ensuring compliance with regulatory limits, and supporting sustainable operations in offshore oil and gas environments.

ORAL PRESENTATION ABSTRACTS

(DAY 1)

SESSION 1A: ENVIRONMENTAL MONITORING & DOSE ASSESSMENT

ICHLERA11 – 25

Investigation on the Concentration of Uranium in Potable Water of Bangalore, India – A Comprehensive Study

Nagaiah N[1,*], Gladys Mathews[1], Ambika M.R[2], Karthik Kumar M.B[3], Karunakara N[4], Sultan J. Alsufyani [5], Bradley D A[6,7], Mayeen Uddin Khandaker[6,8]

[1]Department of Physics, Bangalore University, JB Campus, Bengaluru-560056, India
[2]Department of Physics, M S Ramaiah Institute of Technology, Bengaluru-560054, India
[3]Department of Physics, Don Bosco Institute of Technology, Bengaluru-560085, India
[4]Centre for Advanced Research IN Environmental Radioactivity, Mangalore University, Mangaluru-574199, India
[5]Department of Physics, College of Science, Taif University, P.O.Box 11099, Taif 21944, Saudi Arabia
[6]Applied Physics and Radiation Technologies Group, CCDCU, School of Engineering and Technology, Sunway University, Bandar Sunway 47500, Selangor, Malaysia.
[7]School of Physics and Mathematics, University of Surrey, Guildford, GU2 7XH, United Kingdom
[8]Faculty of Graduate Studies, Daffodil International University, Daffodil Smart City, Birulia, Savar, Dhaka-1216, Bangladesh

Corresponding author's email address: nagaiahn@rediffmail.com

Abstract:

Bangalore is one of the fastest growing cities in Asia and is located in the south eastern part of Karnataka State, India. About 40% of the population of Bangalore is dependent on groundwater. The over - exploitation of groundwater has resulted in the lowering of the water table and drying of shallow aquifers. ^{238}U, ^{226}Ra and ^{222}Rn are the most prevalent radioactive elements found in groundwater. According to an estimate, food contributes about 15%, whereas drinking water contributes 85% of ingested uranium to the human system. The incorporated uranium is known to affect the normal functioning of the kidney, brain, liver, heart and other systems. Besides, being weakly radioactive, uranium is chemically toxic as it is a heavy element. Hence, the study of measurement of uranium levels in the drinking water in the living environment is very important. In the present study, the sampling locations were selected systematically in and around Bangalore city. Groundwater samples which were collected from bore wells were analysed for the total uranium concentration using Laser flourimeter. The results reveal that, about 40% of the groundwater samples cross the safe limit of 30 µg/L set by WHO and 22% of the water samples showed the concentration of uranium greater than 120 µg/L. The southeast region of Bangalore city has the highest percentage of uranium concentration. It was found that about 22% of water samples cross the safe limit of 100 µSv/y for annual effective dose. The maximum value found for lifetime cancer risk is 6.46×10^{-3}. The age dependent analysis reveals that the infants (<1y) and boys (14 - 18y) are at a higher risk of radiological toxicity compared to other age groups. About 40% of the groundwater samples showed the value of Lifetime Average Daily Dose (LADD) and Hazard Quotient (HQ) greater than the reference values. The concentration of uranium in the groundwater samples showed weak positive correlation with pH, TDS, Ca, Mg & HCO_3, whereas, moderate positive correlation with K, Cl, CO_3, Pb & Cu but a negative correlation with Na, F & Zn. Thus, it can be concluded that the chemical toxicity of uranium as a heavy element should be of more concern compared to its radiological toxicity.

ICHLERA11 – 58

Identification of High-Level Background Radiation Areas and Assessing Radiation Exposure in Malaysia

Mayeen Uddin Khandaker[1],*

[1]*Applied Physics and Radiation Technologies Group, CCDCU, School of Engineering and Technology, Sunway University, 47500 Bandar Sunway, Selangor, Malaysia*

Corresponding author's email address: mayeenk@sunway.edu.my

Abstract:

Understanding the distribution of natural background radiation in a country is essential for public health and environmental protection. Malaysia, with its diverse geological formations and demographic patterns, presents a unique landscape for investigating radiation exposure. This work aims to (1) identify regions within Malaysia with elevated levels of background radiation and (2) assess the potential radiation exposure to the population residing in these areas and other areas via foodstuffs and commodities originated from the elevated level of radiation areas. A comprehensive study was conducted using high-precision radiation detectors to measure the concentrations of naturally occurring radionuclides in strata and foodstuffs across various geographical locations in Malaysia. Data collected were analyzed to identify hotspots with significantly higher radiation levels compared to the national average. Additionally, population density and demographic information were considered to estimate potential radiation exposure to individuals living in these areas. Several regions were identified as having elevated background radiation levels, primarily due to the presence of naturally occurring radioactive materials in the beach sand, sediment, soil and rocks. These areas were predominantly located in regions with geological formations rich in thorium and thorium bearing minerals. The potential radiation exposure to the population residing in these areas was estimated based on the measured radiation levels and demographic data. The findings of this study provide valuable insights into the distribution of background radiation in Malaysia. By identifying high-level radiation areas and assessing potential exposure, this research contributes to the development of effective radiation protection measures and public health policies in the country.

ICHLERA11 – 28

Radiation Risk Assessment for NTHU Biotechnology Building: Feasibility Study

Tsi-chian Chao[1], Neng-Chuan Tien[2]

[1]*Medical Imaging and Radiological Sciences, Chang Gung University, Taiwan*
[2]*Nuclear Science and Technology Development Center, National Tsing Hua University*

Corresponding author's email address: chaot@mail.cgu.edu.tw

Abstract:

The National Tsinghua University (NTHU) Biotechnology Building, formerly known as the Radiation Biology Building, faced Cesium-137 contamination during its 1978 construction. In 2012, NTHU engaged the "Radiation Protection Association, R.O.C." to comprehensively detect contamination, measuring dose rates across various locations. The critical question: Could these doses lead to statistically significant cancer cases? Our study aims to explore the feasibility of epidemiologically investigating radiation-induced cancer risk among NTHU's exposed population. While international studies involve large samples, NTHU's exposure group comprises only 636 individuals, with relatively low measured doses. Determining statistical significance remains pivotal. Our quantitative research evaluates pros and cons, serving as a reference for subsequent actions. We use relative risk (RR) and excess relative risk (ERR) to assess radiation-induced cancer risk. Comparing standardized incidence rate ratios with Taiwan's 2018 Cancer Registry data, we calculate statistical power and sample size. Expert review will guide recommendations on proceeding with a detailed epidemiological study. Despite cumulative average doses (0.478 mSv) and maximum doses (4.205 mSv), annual exposures did not significantly differ from background levels. For male lung cancer, the ERR was 0.0003607—only 0.4% higher than the background rate (81.2 per 100,000). However, with 636 exposed individuals and Taiwan's 23 million population, statistical significance remains elusive. Using average ERR would require even larger samples. Thus, the dosimetric data for NTHU exposed population lacks sufficient power to examine radiation-cancer associations.

ICHLERA11 – 08

External Gamma Ray Dose Assessment to Population along the Southern Coastal Area of Tamil Nadu with Statistical Approach

A. Chandrasekaran[1], Ismail M. M. Rahman[2,*]

[1]*Department of Physics, Sri Sivasubramaniya Nadar College of Engineering (Autonomous), Kalavakkam, Chennai, 603 110, India*
[2]*Institute of Environmental Radioactivity, Fukushima University, 1 Kanayagawa, Fukushima City, Fukushima 960-1296, Japan*

Corresponding author's email address: chandrasekarana@ssn.edu.in (AC); immrahman@ipc.fukushima-u.ac.jp (IMMR)

Abstract:

The activity concentrations of natural radionuclides ^{238}U, ^{232}Th, and ^{40}K along Tamil Nadu's southern coastline were determined. The associated radiation hazards were then computed to determine natural background radiation levels. The average activity concentrations for ^{238}U, ^{232}Th, and ^{40}K were 29, 218.10, and 79.67 Bq kg^{-1}, respectively. Radium equivalent activity, absorbed dose rate, annual effective dose rate, external hazard index, annual gonadal dose equivalent, and excess lifetime cancer risk were among the radiological characteristics measured. The data were compared to reported values from several worldwide regions and assessed against UNSCEAR-recommended levels. Furthermore, multivariate statistical approaches such as Pearson correlation, principal component analysis were used to investigate the correlations between the radioactive variables.

SESSION 3: RADIOBIOLOGICAL EFFECTS, EPIDEMIOLOGY & HEALTH IMPACTS

ICHLERA11 – 17

Natural Radioactivity Levels and Radiological Risks in Some Medicinal Plants Consumed in Northern Nigeria

Hauwau Kulu Shuaibu[1,2,*], Abdu Nasiru Muhammad[1,3], Matthew Tikpangi Kolo[4], Mayeen Uddin Khandaker[5,6]

[1]*Nuclear Technology Research Centre, Faculty of Science and Technology, Universiti Kebangsaan Malaysia, 43600, UKM Bangi, Selangor, Malaysia*
[2]*Department of Physics, Faculty of Science, Nigerian Defence Academy, PMB, 2109, Kaduna, Nigeria*
[3]*Nigerian Nuclear Regulatory Authority (NNRA), Plot 564/565 Airport Road, Central Business District, Abuja, Nigeria*
[4]*Department of Physics, Federal University of Technology, Minna, Niger State, Nigeria*
[5]*Applied Physics and Radiation Technologies Group, CCDCU, School of Engineering and Technology, Sunway University, 47500, Bandar Sunway, Selangor, Malaysia*
[6]*Faculty of Graduate Studies, Daffodil International University, Daffodil Smart City, Birulia, Savar, Dhaka, 1216, Bangladesh*

Corresponding author's email address: drhks1618@gmail.com

Abstract:

The use of natural medicinal plants to treat diverse illnesses in northern Nigeria has been an age-long practice, especially among the locals. Plant parts like the leaves, bark, roots, and seeds are often administered raw or as herbal extracts without regulations. Nevertheless, elevated levels of natural radionuclides in medicinal plants have raised concerns about radiological risks from their consumption. For this reason, 12 commonly used medicinal plants in northern Nigeria were sampled and analysed for their natural radioactivity contents by a gamma-ray spectrometric technique using HPGe. The total annual effective doses due to ingestion of the medicinal plants and the corresponding excess lifetime cancer risk (ELCR) were computed from the measured radioactivities. Mean activity concentrations of ^{238}U, ^{232}Th, and ^{40}K were found to be 44±2, 38±2, and 5884±126 Bq/kg, respectively. The highest ^{238}U activity concentration of 89±2 Bq/kg was found in Zingiber officinale Roscoe (Ginger), while Khaya senegalensis (African mahogany) recorded the highest ^{232}Th activity of 63±1 Bq/kg. Total committed annual effective doses varied between 98 and 162 μSv/y, with an average value of 134 μSv/y. These values were lower than the global mean annual committed effective dose of 0.3 mSv/y for ingestion of natural radionuclides documented in the 2000 Report of the United Nations Scientific Committee on the Effects of Atomic Radiation. Computed excess lifetime cancer risk ranged from 4.97×10^{-4} to 7.52×10^{-4}, with a mean of 6.69×10^{-4}. Although the results of this research did not suggest any radiation incidence that will require urgent attention, they provide baseline information that will assist the regulatory agencies in formulating policies and guidelines for human protection. The findings will also help set up standards and regulations for the harmless consumption of medicinal plants from the radiation protection point of view.

ICHLERA11 – 21

Dosimetric and Radiobiological Impacts of Radon Exposure on Skin: A Monte Carlo Simulation Study

Ali Taheri[1*], Mayeen Uddin Khandaker[2], David Andrew Bradley[3]

[1]*Applied Physics and Radiation Technologies Group, CCDCU, School of Engineering and Technology, Sunway University, Malaysia*
[2]*Faculty of Graduate Studies, Daffodil International University, Bangladesh*
[3]*School of Mathematics and Physics, University of Surrey, United Kingdom*

Corresponding author's email address: alitmedical@gmail.com

Abstract:

Radon, a naturally occurring radioactive gas found in mineral spring waters, has been studied for its potential health effects. The ^{222}Rn isotope decays by alpha particle emission, and its progeny emit alpha, beta, and gamma radiation, leading to localized radiation exposure. While the absorbed dose to organs from radon inhalation and ingestion is well-studied, the impact of radon on skin cells, the deposited dose to different skin layers, and DNA damage due to this dose are inadequately explored. Human exposure to radon-rich mineral waters, such as during bathing or spa treatments, can result in dissolved radon interacting with the skin and posing potential risks.

This study pioneers the understanding of radon exposure's radiobiological impact on the epidermal skin layer through computer simulation. Using the advanced Monte Carlo simulation code TOPAS, we investigate the depth dose within the epidermal layer and the deposited dose in a single skin cell at 70 microns depth from the surface when exposed to radon-containing mineral spring water. This depth aligns with the International Commission on Radiation Units and Measurements (ICRU) recommendation for skin dosimetry reference depth. Additionally, we explore direct DNA damage to skin cells due to radon exposure using the TOPAS-nBio extension, quantifying single-strand breaks (SSBs) and double-strand breaks (DSBs) yields.

Preliminary simulations indicate that the deposited dose in the epidermal layer decreases by 99% within the first 10 microns from the surface, indicating the alpha particles as the primary irradiation source from ^{222}Rn. At the 70-micron depth, the dose is primarily from beta particles, with the deposited dose approximately two orders of magnitude lower than at the surface. The DSB yield in the surface skin cell is estimated at 10 DSB/Gbp/Gy, aligning with reported yields from alpha particles within a similar linear energy transfer (LET) range in existing literature.

SESSION 4: MAN-MADE SOURCES AND HANDLING OF HUMAN EXPOSURES & RESPONSIBILITIES

ICHLERA11 – 51

Regression Analysis of Body-Mass Index and Radiation Dosimetry of Whole-Body PET/CT Using Machine Learning Algorithm

Lukuman Bashiru[1], Muhammad Khalis Abdul Karim[1], Izdihar Kamal[1], Yazid Yaakob[1], Dahlang Tahir[2], Mohamad Johari Ibahim[3]

[1]*Department of Physics, Universiti Putra Malaysia, Malaysia*
[2]*Department of Physics, Universitas Hasanudin, Indonesia*
[3]*Department of Biochemistry, Faculty of Medicine, Universiti Teknologi MARA*

Corresponding author's email address: gs68204@student.upm.edu.my

Abstract:

This study investigates the correlation between Body-Mass Index (BMI) and PET-CT dosimetry, by employing advanced machine learning algorithms to optimize radiation dosage while preserving image quality. Given the increasing prevalence of PET-CT procedures, the associated risk of radiation-induced carcinogenesis due to potential cellular mutations is a significant concern. 1000 subjects, comprising 484 males and 516 females, with a mean age of 53.63 y/o (16 – 87 y/o) have underwent PET-CT procedure were retrospectively analysed. All subjects have been administered with the radiotracer fluorine-18-fluorodeoxyglucose (^{18}F-FDG) prior imaging procedure and have BMI ranging from 12.48 to 47.32 kg/m². The mean and range of radiation dose for; administered dose, volume weighted CT dose index ($CTDI_{vol}$) and Dose Length Product (DLP) were 9.65 MBq (0.85–15.08 MBq), 9.20 mGy (1.36–16.92 mGy) and 260.5 mGy·cm (45.2–518.7 mGy·cm), respectively. Furthermore, the machine learning algorithms were applied e.g linear regression, support vector machines, regression trees, efficient linear regression, and Gaussian process regression to predict the relationship between BMI and dosimetry parameters. Linear regression and stepwise linear regression models demonstrated the best performance for PET dose prediction, with the lowest RMSE (1.5358) and highest R^2 (0.0172), while Gaussian process regression emerged as the most effective model for CT dose prediction, with the lowest RMSE (1.3376) and highest R^2 (0.8102). Hence, the findings emphasize the potential for significant dose reductions based on BMI, thereby enhancing treatment outcomes and patient safety according to the ALARA (As Low As Reasonably Achievable) principle. This optimal analytical approach was systematically applied to conventional dosimetry parameters to accurately determine the recommended radiation dose for PET-CT procedures.

ICHLERA11 – 02

Assessing Occupational Radiation Exposure Trends and Safety Interventions for Healthcare Professionals at a University Hospital in Saudi Arabia (2020-2022)

Zuhal Y. Hamd[1], Haifa I. Alrebdi[2], Shahad Alabdul-Monem[2], Melaf Alshammeri[2], Rawan Alhowaymel[2], Mashael Al-dosari[2], Mohamed Abuzaid[3,4]

[1]Department of Radiological Sciences, College of Health and Rehabilitation Sciences, Princess Nourah bint Abdulrahman University, P.0 .84428, Riyadh, 11671, Saudi Arabia; Z.Y.H; Zyhamd@pnu.edu.sa
[2]Department of Physics, College of Sciences, Princess Nourah bint Abdulrahman University, P.0 .84428, Riyadh, 11671, Saudi Arabia
[3]Medical Diagnostic Imaging Department, College of Health Sciences, University of Sharjah, Sharjah, United Arab Emirates, MMA; mabdelfatah@sharjah.ac.ae
[4]Research Institute for Medical and Health Sciences, University of Sharjah, Sharjah, United Arab Emirates

Corresponding author's email address: zuhalhamd2019@gmail.com

Abstract:

This study investigates the occupational radiation exposure levels among 50 healthcare professionals, including Technologists, Nurses, and Radiologists, who were monitored for radiation doses across various operational scenarios within the Diagnostic Radiology and Nuclear Medicine departments at a university hospital, consisting of approximately 54% males and 46% females, from 2020 to 2022. The lowest recorded radiation exposure was 0.11 mSv, and the highest was 0.88 mSv, with all values remaining below the recommended safety limit of 20 mSv. Results indicate that both departments experienced reduced radiation exposure in 2020 due to pandemic-related operational changes, with subsequent years showing divergent trends. The Diagnostic Radiology department stabilized radiation levels, suggesting effective refinement of safety protocols. In contrast, the Nuclear Medicine department observed a concerning increase in radiation exposure, highlighting areas needing enhanced safety measures. A Machine Learning Linear Regression model has been used to examine the relationship between various predictor variables and the radiation levels. Its result shows that these predictors explain only about 9.2% of the variance in radiation levels. This study underscores the importance of continuous monitoring and tailored interventions to ensure the health and safety of radiation workers, reflecting dynamic changes in healthcare practices and the critical need for robust radiation safety frameworks.

ORAL PRESENTATION ABSTRACTS

(DAY 2)

SESSION 1B: ENVIRONMENTAL MONITORING & DOSE ASSESSMENT

ICHLERA11 – 37

Extravehicular Smart Optical Fibre for Passive Dosimetry in Space (E-SOFPADS)

Farid Bajuri[1,2,3], Norkhairunnisa Mazlan[2,3], Nizam Tamchek[4], Adi Azriff Basri[2,3,5], Nawal Aswan Abdul Jalil[6], Mohd Roshdi Hassan[6], Fathinul Fikri Ahmad Saad[7], Salasiah Mustafa[1,8], Fairul Amin Zaraini[9], Abadi Chanik[9], Ahmad Ammar Ahmad Tarmizi[9], Mohd Helmy Hashim[10,11], Zahira Mohd Radzi[11], David Andrew Bradley[12,13], Noramaliza Mohd Noor[*1,7,14]

[1]*Centre for Diagnostic Nuclear Imaging, Universiti Putra Malaysia, Malaysia*
[2]*Department of Aerospace Engineering, Universiti Putra Malaysia, Malaysia*
[3]*Aerospace Malaysia Research Centre, Universiti Putra Malaysia, Malaysia*
[4]*Department of Physics, Universiti Putra Malaysia, Malaysia*
[5]*Intstitute of Tropical Forestry and Forest Products, Universiti Putra Malaysia, Malaysia*
[6]*Department of Mechanical Engineering, Universiti Putra Malaysia, Malaysia*
[7]*Department of Radiology, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, Malaysia*
[8]*Hospital Universiti Malaysia Sabah, Universiti Malaysia Sabah, Malaysia*
[9]*Satellite Assembly, Integration and Test Facility, Malaysian Space Agency, Malaysia*
[10]*School of Electrical Engineering, Universiti Teknologi MARA, Malaysia*
[11]*Space Exploration and Science Department, Malaysian Space Agency, Malaysia*
[12]*Centre for Radiation Sciences, Sunway University, Malaysia*
[13]*School of Mathematics and Physics, Surrey University, United Kingdom*
[14]*Medical Physics Unit, Hospital Sultan Abdul Aziz Shah, Universiti Putra Malaysia, Malaysia*

Corresponding author's email address: noramaliza@upm.edu.my

Abstract:

Without the protection of the Earth's atmosphere, any object placed in outer space, even at the low altitude of the low Earth orbit (LEO), is exposed to the harsh space environment, especially regarding ionising radiation. This work concerns the space radiation monitoring at LEO altitude where the International Space Station (ISS) is located. In LEO the sources of radiation are cosmic rays and solar radiations consisting of mostly protons. Passive radiation monitoring in space is scarce with most of the missions were conducted by space agencies using the commercial TLD. Here we present the exposure of extravehicular smart optical fibres for passive dosimetry in space (E-SOFPADS) that is being incorporated inside a casing made of polyetheretherketone (PEEK). PEEK is a material with a similar water equivalence to the conventional acrylic phantom that is often used for routine dosimetric purposes. At the same time, PEEK can survive being exposed for extended periods of time in LEO. Aluminium, tungsten and polyethylene filters were employed alongside the dosimeters for removal of calculated energies that exist at the experiment site. The exposure utilised the ExHAM owned by Japan Aerospace Exploration Agency to carry and expose the samples at the exposure facility outside of the Kibo module of the ISS. E-SOFPADS were exposed for 427 days, and further dose correlations were made using 150 MeV proton with fading analysis of up to 358 days upon the return of the samples. The absorbed dose correlations made were up to 2211 μGy/day for section without any filter, lower than MTR-1 experiment which was up to 1000 mGy/day. Locations of experiment, solar activities and other space weather conditions during exposure resulted in differences in absorbed dose conversion. Overall, E-SOFPADS were successful at detecting space radiation paving a new application in space radiation monitoring.

ICHLERA11 – 22

Assessment of Impact of Physico-Chemical Properties and Minerals on Natural Radionuclides and the Associated Radiation Hazards in Beach Sediments Along the Hotspot Tourist Area of Kovalam at Chennai, Tamil Nadu

A. Chandrasekaran[1], H. Osman[2], D.A. Bradley[3,4], M. U. Khandaker[3,5]

[1]*Department of Physics, Sri Sivasubramaniya Nadar College of Engineering (Autonomous), Kalavakkam-603110, Chennai, Tamilnadu, India*
[2]*Department of Radiological Sciences, College of Applied Medical Sciences, Taif University, 21944 Taif, Saudi Arabia; ha.osman@tu.edu.sa (HO)*
[3]*Applied Physics and Radiation Technologies Group, CCDCU, School of Engineering and Technology, Sunway University, 47500 Bandar Sunway, Selangor, Malaysia; mayeenk@sunway.edu.my (MUK)*
[4] *Department of Physics, University of Surrey, Guildford, GU2 7XH, United Kingdom; d.a.bradley@surrey.ac.uk (DAB)*
[5] *Faculty of Graduate Studies, Daffodil International University, Daffodil Smart City, Birulia, Savar, Dhaka-1216, Bangladesh*

Corresponding author's email address: chandrasekarana@ssn.edu.in

Abstract:

The activity concentration of natural radionuclides was determined using NaI (Tl) based gamma-ray spectrometry in beach sediments along the hotspot tourist area of Kovalam at Chennai, Tamil Nadu. Initially, the Physico-chemical properties such as pH, conductivity and % of sand, clay and slit were determined. The average activity concentrations of the radionuclides ^{238}U, ^{232}Th, and ^{40}K in sediment samples are 23.33±4, 145.95±5, and 314.20±13 Bq kg^{-1}. The radiological parameters such as radium equivalent activity (R_{eq}), absorbed dose rate (D_R) annual effective dose equivalent (AEDE), external hazard index (H_{ex}), and gamma radiation representative level index (I_γ) were calculated. The results were discussed in terms of limits to the accepted natural radioactivity levels and compared with similar studies reported in other countries. To identify the heavy minerals associated with natural radionuclides sediment samples are subjected by FT-IR and XRD techniques. The activity ratios ($^{232}Th/^{40}K$ and $^{232}Th/^{238}U$) and correlation between them have been studied to identify the sources of natural radionuclides.

ICHLERA11 – 48

Spatial Distribution of Ambient Gamma Dose Rates in Aksu, a Radon-Prone Area of Northern Kazakhstan

Yasutaka Omori[1], Masahiro Hosoda[1,2], Meirat Bakhtin[3], Yerlan Kashkinbayev[3], Moldir Aumalikova[3], Chutima Kranrod[1], Hiromi Kudo[2], Shinji Yoshinaga[4], Masaharu Hoshi[5], Shinji Tokonami[1]

[1]Institute of Radiation Emergency Medicine, Hirosaki University, Japan
[2] Hirosaki University Graduate School of Health Sciences, Japan
[3]Institute of Radiobiology and Radiation Protection, NJSC Astana Medical University, Kazakhstan
[4]Research Institute for Radiation Biology and Medicine, Hiroshima University, Japan
[5]The Center for Peace, Hiroshima University, Hiroshima University, Japan

Corresponding author's email address: ys-omori@hirosaki-u.ac.jp

Abstract:

Radon-prone area with indoor radon concentrations above 1,000 Bq/m^3 is recently reported in the Aksu settlement, northern Kazakhstan, which is located closely to uranium and gold mining sites. To characterize the settlement radiologically, car-borne and man-borne surveys of outdoor ambient gamma dose rate were performed in the Aksu settlement and surrounding area. In addition, gamma-ray pulse-height distributions were measured to quantify the amounts of radionuclides contributing to the dose rates. The results showed that the ambient gamma dose rates were affected by artificial construction structure. That is, in most cases, the dose rates were higher (80-100 nGy/h) at places close to buildings and on the road. The dose rates were generally low (< 50 nGy/h) on the ground, whereas those higher than 200 nGy/h were found locally like hot spots. The analysis of the gamma-ray pulse height distributions revealed that a few gravels containing large amounts of uranium decay series elements (the surface dose rates from 500 nSv/h to over 20,000 nSv/h) were deposited in the soil at the high dose rate points. In contrast, the dose rates at the nearby points (those within several meters in radius) were close to the normal level. This finding indicates that the high dose rate points are not of geological origin. The study concluded that the outdoor gamma dose rates in the Aksu settlement and surrounding area are generally normal compared to global mean, but they are elevated locally due to man-made reasons.

SESSION 5: NORM & TENORM

ICHLERA11 – 20

Radiological Assessment of Building Materials Containing Radionuclide Substances in Muria Peninsula, Indonesia

Adi Wijayanto[1,2], Suhairul Hashim[1], Ratiko[3]

[1]*Department of Physics, University Teknologi Malaysia (UTM), Skudai, Johor Bahru, 180101, Johor, Malaysia*
[2]*Directorate of Nuclear Facilities Management, National Research and Innovation Agency (BRIN), KST. B.J. Habibie, Tangerang Selatan, 15313, Banten, Indonesia*
[3]*Research Centre for Nuclear Material and Radwaste Tech., National Research and Innovation Agency (BRIN), KST. B.J. Habibie, Tangerang Selatan, 15313, Banten, Indonesia*

Corresponding author's email address: adiwijayanto@graduate.utm.my

Abstract:

The majority of people spend almost 90% of their lives indoors, where they are significantly affected by inherent radioactivity emitted by walls, floors, and ceilings. In Indonesia, common construction materials such as bricks, lightweight bricks, cement, sand, and fly-ash-based ceramic products contain Naturally Occurring Radioactive Materials (NORM) sourced from soil and rocks. This radiation exposure significantly harms health by destroying cells and causing cancer. This paper aims to analyze the estimated effective radiation dose in brick and lightweight brick samples. The analysis begins with sample preparation, followed by measurements using a γ-ray spectrometer with an HPGe detector and an α/β sample counter. The building materials samples were taken from Muria Peninsula: Jepara and Kudus, Indonesia. The contribution of radiation dose from samples, consisting of lightweight bricks, bricks, sand, cement, and fly-ash, are compared using Annual Effective Dose Equivalent (AEDE) and the RESRAD-BUILD software. The γ-ray spectrometer measurements of each sample yielded the following radionuclides: ^{210}Pb, ^{230}Th, ^{226}Ra, ^{232}Th, ^{228}Th, ^{238}U, and ^{40}K. The maximum γ concentration values for each radionuclide in building material samples were (Bq kg^{-1}) 34.69±7.88, 61.20±11.7, 91.64±8.90, 143.27±13.82, 134.39±12.85, 111.73±19.93, and 1137.53±107.8 while the gross α/β concentrations average (Bq kg^{-1}) 56.3±4.42 to 288±6.84. The AEDE were estimated with range 1.24E-01 to 8.91E-01 μSv h^{-1}, while the Excess Life Cancer Risk (ELCR), were calculated with average concentrations of 4.33E-04 to 3.12E-03 respectively. With the RESRAD-BUILD, the exposure to radiation for building material samples during age categories 1>y>17 and time for calculation 1>y>70 assessments were estimated at (mSv y^{-1}) 2.75E-05 to 4.30E-04. Building materials are safe for occupants if this value is less than the effective dose limit of 1 mSv y^{-1} for the general public, as determined by Nuclear Energy Regulatory Agency (BAPETEN) in 2013 adopted from the International Commission on Radiological Protection (ICRP) in 1999.

ICHLERA11 – 24

Investigation of Radiation Exposure at Tin Smelting Plants in Bangka, Indonesia

Pradana Radhia[1,2], D. Nugraha Eka[1], Wahyudi Wahyudi[1], Wiyono Muji[1], D. Winarni Ilma[1], Chutima Kranrod[3], Michiya Sasaki[4], Devriany Ade[5], Yasutaka Omori[3], Shinji Yoshinaga[6], Masahiro Hosoda[2,3], And Shinji Tokonami[3]

[1]*Research Center for Safety, Metrology, and Nuclear Technology, The National Research and Innovation Agency of Indonesia (BRIN), Tangerang Selatan, Indonesia*
[2]*Department of Radiation Science, Graduate School of Health Sciences, Hirosaki University, Hirosaki, Japan*
[3]*Institute of Radiation Emergency Medicine, Hirosaki University, Hirosaki, Japan*
[4]*Biology and Environmental Chemistry Division, Sustainable System Research Laboratory, Central Research Institute of Electric Power Industry, Chiba, Japan*
[5]*Health Ministry Polytechnic of Pangkal Pinang, Bangka Tengah, Indonesia 6Research Institute for Radiation Biology and Medicine, Hiroshima University, Hiroshima, Japan*

Corresponding author's email address: tokonami@hirosaki-u.ac.jp

Abstract:

The smelting process in the tin industry is associated with the Technologically Enhanced Naturally Occurring Radioactive Material (TENORM), especially contained in the tin slag, the by-product of the process. Hence, the tin smelting plant workers may be significantly exposed to radiation. The main sources of radiation exposure from the plant are the ^{238}U and ^{232}Th decay chains and ^{40}K, which contribute to external exposure. Radon (^{222}Rn) and thoron (^{220}Rn), as the decay products of ^{238}U and ^{232}Th, respectively, may also contribute to the exposure through inhalation. This study aims to conduct a preliminary investigation of the occupational exposure of the workers in tin smelting plants; therefore, we conducted investigations at three tin smelting plants in Bangka. Ambient dose equivalent rates were measured using a NaI(Tl) scintillation detector. In addition, the radon and thoron concentrations were measured using a portable radon-thoron monitor. The highest dose rate of up to 3.16 μSv h^{-1} was measured in the tin slag storage and the tin smelter furnace at about 0.62 ± 0.09 μSv h^{-1}. The result of the 2-day measurement in the tin smelter showed the highest measured concentration of 54 Bq m^{-3} and 112 Bq m^{-3} for radon and thoron, respectively. The gamma radiation in the tin smelter factory was mainly from the tin slag in the storage and the smelting furnace, where dose constraint should be applied to limit the dose received by the workers. Due to the design and the blower function of the smelter facility, the radon and thoron concentrations in the tin smelter factory were much lower than the recommended value of 200 Bq m^{-3} and 300 Bq m^{-3} for radon in the workplace by the Indonesian Ministry of Manpower Regulation No. 5 of 2018 and the International Commission on Radiological Protection (ICRP), respectively.

ICHLERA11 – 10

Elevated Naturally Occurring Radioactive Materials (NORMs) in Groundwater of Artisanal Gold and Gemstone Mining Sites

Matthew Omoniyi Isinkaye[1], Oyindamola Paulinah Fasanmi[1]

[1]*Department of Physics, Faculty of Science, Ekiti State University, Ado Ekiti, Nigeria*

Corresponding author's email address: matthewisinkaye@eksu.edu.ng

Abstract:

The purpose of this study is to examine the presence and high concentrations of naturally occurring radioactive materials (NORMs) in groundwater in Southwest Nigerian artisanal gold and gemstone mining sites. Due to the potential for NORM releases into the environment, artisanal mining practices are known to have an adverse effect on the ecosystem. Elevated NORM levels in groundwater can be extremely dangerous for the ecosystem and for human health. In this work, ^{40}K, ^{238}U, and ^{232}Th were measured in groundwater samples taken from artisanal mining regions in Southwest Nigeria using a gamma spectrometric approach. To evaluate the level of contamination and related dangers resulting from NORMs in the groundwater samples, statistical, deterministic and Monte Carlo simulation methods were utilized. The results show that the mean activity concentration of NORMs in groundwater samples from the various mining sites was 220.35 ± 64. 43 Bq/L for ^{40}K, 10.53 ± 1.80 Bq/L for ^{238}U and 17.42 ± 3.92 Bq/L for ^{232}Th. All these values exceed the respective limits recommended by World Health Organization (WHO) as safe values for drinking water. The assessment of radiological risks shows that the groundwater of the study area portend a significant risk to the population. Based on the results of this research, it can be concluded that the groundwater of the study area contained elevated levels of NORMs.

ICHLERA11 – 19

Safe Handling and Management of Industrial Residues Containing Naturally Occurring Radioactive Materials (NORM)

Razali Harun

Universiti Kebangsaan Malaysia, Bangi, Selangor, Malaysia

Corresponding author's email address: razalihk7@gmail.com

Abstract:

In Malaysia, industrial residues containing Naturally Occurring Radioactive Materials (NORM) are typically generated from activities associated with upstream and midstream mining sectors including oil and gas, land mining, ore smelting and metal refining, rare earth processing and mineral sands separation operations as well as recycling of industrial residues for recovery of valuable metals. Dealing with NORM radioactivity is governed under Atomic Energy Licensing Act 1984 [Act 304] and its relevant Regulations through the Department of Atomic Energy (Atom Malaysia). A control limit of NORM radioactivity is established below 1.0 Bq/g and controlled under specific permits and licenses by Atom Malaysia. Industrial residues with no longer feasible for further recycling or recovery process maybe disposed of in accordance with current standards and requirements established by Atom Malaysia. A detailed site assessment and safety evaluation called a Radiological Impact Assessment (RIA) will be required in managing larger volumes of NORM residues or decommissioning of facilities that are contaminated with NORM radioactivity. Under the RIA, safe handling methodologies and mitigation measures shall be verified and approved by Atom Malaysia prior its implementation. Radiological and environmental monitoring program shall be established and implemented to monitor radiological conditions in the surrounding environment during NORM handling activities to monitor dose exposure is keep as low as reasonably achievable (ALARA) and ensure the health and safety of workers, members of the public and environment.

SESSION 6: REGULATORY CONTROL & RESPONSIBILITIES AND NOVEL RADIATION PROTECTION PHILOSOPHY & CONCEPTS

ICHLERA11 – 15

Licensing and Enforcement Activities for Facilities Dealing with Naturally Occurring Radioactive Materials (NORM)

Teng Iyu Lin, Suhana Jalil, Mohd Zulfadli Ramli & Muhamad Hassyakirin Hasim

Department of Atomic Energy, Batu 24 Jalan Dengkil, 43800 Dengkil, Selangor, Malaysia

Corresponding author's email address: yulin@aelb.gov.my

Abstract:

In Malaysia, the Atomic Energy Licensing Board is the regulatory body to control the usage of atomic energy activities under the Atomic Energy Licensing Act 1984 (Act 304) through the Department of Atomic Energy (Atom Malaysia). The atomic energy activities including the Naturally Occurring Radioactive Materials (NORM) facilities, research reactor, irradiation facility, non-destructive testing activities, gauging, research and education. Atom Malaysia also developed the guidelines to guide to the applicants for the license and also to further facilitate the licence holders. The licensing of NORM milling facilities (such as rare earth extraction plant), shall be in 3 parts namely, siting, construction and operation. Operation licence is divided into 2 stages, i.e temporary operating licence and full operating licence. Technical information specifically required for operating of nuclear installation including all of the information regarding design, description of the facility, site characteristic, environmental and monitoring are recorded together in a document called Radiological Impact Assessment (RIA). Inspection, radiological monitoring and environmental sampling are carried out to verify the activities safe and under control as well as to ensure the compliance of safety, security and safeguards of nuclear material. However, the investigation and prosecution will be involved where there are activities against the regulatory requirements. Detail examination by the expert, called expert witness will be done to support the case with the expert report. Atom Malaysia can issue the direct stop operation until the offence being rectify or if the serious case, Atom Malaysia will bring the case to the court. Lastly, Atom Malaysia also responsible to manage the operation of nuclear response which includes NORM related emergencies and nuclear security incidents. This ensures that the responses are executed according to established plans, procedures, and in an effective manner.

ICHLERA11 – 14

Assessment of Typical Dose Values for Establishing DRLs of Whole-Body ^{18}F-FDG PET/CT Scan in Malaysia Cancer Centre

Husain Murat[1,2], Mohd Mustafa Awang Kechik[2], Izdihar Kamal[2], Mohamad Aminudin Said[3], Muhammad Khalis Abdul Karim[2]

[1]*Department of Nuclear Medicine, Hospital Sultanah Aminah Johor Bahru, Malaysia*
[2]*Department of Physics, Faculty of Science, Universiti Putra Malaysia, Serdang, Malaysia*
[3]*Department of Nuclear Medicine, Institut Kanser Negara, W.P. Putrajaya, Malaysia*

Corresponding author's email address: mkhalis@upm.edu.my

Abstract:

Diagnostic Reference Levels (DRLs) are essential benchmarks for optimizing patient protection in diagnostic nuclear medicine procedures. This study explores the application of DRLs in adult whole-body (WB) ^{18}F-FDG PET/CT scan to optimize patient safety. Therefore, the study aims to establish typical dose values for adult WB ^{18}F-FDG PET/CT scan and to compare these values with established DRLs. We retrospectively analyzed administered activity, A_A (MBq), administered activity per body weight, $A_{A/BW}$ (MBq/kg), computed tomography dose index volume ($CTDI_V$), and dose length product (DLP) data from 831 adult patients with an average body weight of 69.06 ± 5.85kg at our oncology center. Descriptive statistical methods were employed to determine the typical dose (median) values and assess their alignment with established DRLs. The analysis showed that the A_A ranged from 160.95 to 1176.60 MBq, with an average of 305.76 ± 66.88 MBq and median value of 296.37 MBq. Consequently, the $A_{A/BW}$ ranged from 2.06 to 14.87 MBq/kg, with an average of 4.43 ± 0.87 MBq/kg and a median value of 4.31 MBq/kg. For CT, the average CTDIv value was 9.91 mGy and median value was 7.73 mGy, with a range of 4.3 to 838 mGy. The average DLP value was 843.54.00 mGy.cm, with values ranging from 109.46 to 1621.79 mGy.cm. While these figures align with current international DRLs, notable variability was observed due to differences in patient size and scan protocols. Our findings indicate that patient protection for adult WB ^{18}F-FDG PET/CT scan at our center generally meet international standards. However, the observed dose variability suggests a need for further optimization to ensure more consistent application of DRLs.

SESSION 7: ENVIRONMENTAL MODELLING FOR RADIATION PROTECTION

ICHLERA11 – 13

A Multi-Disciplinary Approach to Assessing Natural Radioactivity in Groundwater Samples in High Background Areas Based on ML, GIS and RS

Othman Abdulrahman Fallatah[1,2]

[1]*Faculty of Engineering, Nuclear Engineering Department, King Abdulaziz University, P.O. Box 80204, Jeddah 21589, Saudi Arabia*
[2]*Faculty of Engineering, Radiation Protection and Training Centre, King Abdulaziz University, P.O. Box 80204, Jeddah 21589, Saudi Arabia*

Corresponding author's email address: ofallatah@kau.edu.sa

Abstract:

Several strategies and plans have been prepared by the Kingdom of Saudi Arabia (KSA) for conserving natural resources, which promote 17 sustainable development goals as part of the Kingdom's 2030 vision. One of the strategy's six goals is to ensure good water quality for all. There has been a report of higher radionuclide concentrations in groundwater in a number of regions within the KSA. Geochemical, geological, and hydrogeological conditions greatly influence the concentration of radioactive radionuclides in groundwater. The purpose of this study is to develop conceptual models that relate the radioactivity of groundwater in KSA to the geological and hydrogeological conditions of their aquifer systems. An integrated approach that combines an automated machine learning (AML) approach to quantify relationships between gross α and gross β activities and different geological, hydrogeological, and geochemical conditions. A total of 64 ground water samples will be analyzed in several cities around KSA. These samples will be analyzed using remote sensing data and tools, hydrogeological investigations, field observations, and geochemical analyses. This will enable us to answer these three research questions: (1) Does the geology of the groundwater affect radioactivity? (2) How do hydrogeological conditions (e.g., groundwater recharge and depletion rates) affect groundwater radioactivity? As well as (3) What is the relationship between chemistry (e.g., anions, cations) with gross α and gross β activities using the AML approach? These results will be published in a GIS format (e.g., raster and shapefiles) and will be available to locals, researchers from universities and institutions, and decision makers in different government agencies in KSA upon request.

ICHLERA11 – 39

Application of Computational Fluid Dynamics (CFD) Modelling for Predicting the Transport and Dispersion of $^{14}CO_2$ in the Atmospheric Air in the Vicinity of a Nuclear Power Plant

Bharath[1], Venkateshan R,[2] and Karunakara N[1]

[1]*Centre for Advanced Research in Environmental Radioactivity (CARER), Mangalore University, Mangalagangothri –574199, India*

[2]*Former Head Radiological Environmental Safety Division, IGCAR, Kalpakkam-603102, India*

Corresponding author's email address: drkarunakara@gmail.com

Abstract:

Computational Fluid Dynamics (CFD) modelling is a useful tool for simulating transportation and dispersion of pollutants in the environment, especially in regions with complex topographies, obstacles and structures where commonly used models such as the Gaussian Plume Model (GPM) have limitations. The CFD-based atmospheric dispersion model utilises conservation equations solve three-dimensional turbulent transport equations, enabling accurate predictions of temperature distributions, velocity fields, and concentration variations across the domain. In this study, we investigate the application of CFD simulations to investigate the dispersion patterns of ^{14}C released from a pressurised heavy water reactor nuclear power plant (PHWR NPP) situated in complex terrain. The ^{14}C may be released from the PHWR NPP during routine operation, primarily in oxidised form (as $^{14}CO_2$), and its monitoring in the environment is important for radiation dose assessment. In this study, the dispersion of the $^{14}CO_2$, released through the 100 m height gaseous effluents stack of the NPP, in the downwind and upwind directions with respect to the stack was modelled using the CFD (*fluidyn*–PANACHE) code. This model incorporates three-dimensional GIS data, boundary conditions, body-fitting mesh generation, meteorological data, and stack emission rates to predict the transportation and dispersion of the gaseous plume. Both horizontal and ground-level plume dispersion were evaluated. To evaluate the capability and accuracy of the CFD code, the results obtained from CFD simulations were compared with field measurements of ^{14}C specific activity (Bq $kg^{-1}C$) in the ambient air at different atmospheric air monitoring stations at ground level. The simulated dispersion patterns matched well with the observed patterns with a deviation of <20%. The analysis of the data showed minimal scatter among predicted values, indicating a high degree of reliability. Statistical analyses further confirmed the efficacy of the model and its useful application in the prediction of the transport and dispersion of pollutants.

ICHLERA11 – 43

Evaluation of Jute/Polyester and Glass/Polyester as Shielding Materials for the International Space Station (ISS) Against Cosmic Radiation

Mehdi Hassanpour[1,*], Marzieh Hassanpour[1], Mohammadreza Rezaie[1], Mohammad Rashed Iqbal Faruque[1,*], Mayeen Uddin Khandaker[2,3]

[1]Space Science Centre (ANGKASA), Institute of Climate Change (IPI), Universiti Kebangsaan Malaysia, Malaysia.
[2]Applied Physics and Radiation Technologies Group, CCDCU, School of Engineering and Technology, Sunway University, Bandar Sunway, Selangor 47500, Malaysia
[3]Faculty of Graduate Studies, Daffodil International University, Daffodil Smart City, Birulia, Savar, Dhaka 1216, Bangladesh

Corresponding author's email address: : mhassanpour67@yahoo.com; p109951@siswa.ukm.edu.my; rashed@ukm.edu.my

Abstract:

The International Space Station (ISS) is continuously exposed to space radiation, posing a significant risk to both personnel and equipment due to high-flux cosmic particles. Therefore, developing an effective shielding material for the ISS structure is of paramount importance. In this study, two materials, jute/polyester and glass/polyester, are proposed as potential shielding solutions for the ISS. The study examines the impact of cosmic sources such as protons, neutrons, gamma rays, and cosmic oxygen on the ISS structure incorporating these materials. The analysis was conducted using the MCNPX code, with a focus on spallation activation. High-energy particles can alter materials or stop charged particles, leading to spallation and secondary particle production. Finally, the resulting secondary particles and long-lived radionuclides were identified, characterized, and analysed. The findings suggest that jute/polyester and glass/polyester, in addition to their favourable physical and chemical properties, may serve as effective shielding materials against cosmic particles for the International Space Station (ISS).

ORAL PRESENTATION ABSTRACTS

(DAY 3)

SESSION 1C: ENVIRONMENTAL MONITORING & DOSE ASSESSMENT

ICHLERA11 – 61

Assessment of Thyroid Counter Accuracy Using Caesium-137 and Europium-152 Radionuclides

R.S. Omar[1], M.N. Mazlan[2], F. Mohamed[3], and N.F. Ismail[4]

[1,2,3]Department of Applied Physics, Faculty of Science and Technology, Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor, Malaysia
[4]Agensi Nuklear Malaysia (Nuklear Malaysia), 43000 Kajang, Selangor, Malaysia

Corresponding author's email address: ratna@ukm.edu.my

Abstract:

Routine medical check-ups for radiation workers are essential to ensure their annual radiation dose does not exceed the regulatory limit of 20 mSv, as mandated by radiation protection programs. Licensees are responsible for adhering to regulatory authority requirements and ensuring the safety and health of workers and the public from ionizing radiation. Dose assessment for radiation workers is crucial, especially in evaluating potential cancer risks associated with occupational exposure. One effective dose assessment method is using a thyroid counter, which measures radiation exposure in the neck region, particularly focusing on the thyroid gland. Accurate and reliable thyroid counters are vital to alleviate concerns among radiation workers regarding their exposure levels. This study aimed to monitor background radiation levels for accurate internal dose assessment and to evaluate the performance and reliability of the thyroid counter system used at Agensi Nuklear Malaysia, Kajang, for monitoring thyroid doses among radiation workers. Key components of the performance evaluation included: (i) Background radiation monitoring under two different conditions, (ii) Quality control testing using Cs-137 and Eu-152 radioactive sources, (iii) Statistical analysis with the chi-square test, and (iv) Assessment of the Minimum Detectable Activity (MDA). Results demonstrated that: (i) There was no significant difference in background radiation levels under different conditions, (ii) Quality control test results were within the specified range of ±5%, (iii) The chi-square test results fell within the acceptable range of 4.1 to 14.7, and (iv) The MDA assessment confirmed the thyroid counter's capability to detect low-level radionuclide activity with extended measurement times. Overall, the performance evaluation indicated that the thyroid counter is reliable and meets factory specifications, ensuring it can be safely used for accurate dose monitoring among radiation workers.

ICHLERA11 – 05

Determination of Natural Radioactivity in Soil Samples Collected from Pallikaranai Solid Waste Dumping Site in Chennai, Tamil Nadu

Shakeel J[1], A.S. Ezhil meenaa[1], V.Sahana Sree[2], Augustine Wisely Bezalel[1], A.Chandrasekaran[3]

[1]*Department of Biomedical Engineering, Sri Sivasubramaniya Nadar College of Engineering (Autonomous) Kalavakkam-603110, Tamil Nadu, India*
[2]*Department of Information Technology, Sri Sivasubramaniya Nadar College of Engineering (Autonomous) Kalavakkam-603110, Tamil Nadu, India*
[3]*Department of Physics, Sri Sivasubramaniya Nadar College of Engineering (Autonomous) Kalavakkam-603110, Tamil Nadu, India*

Corresponding author's email address: chandrasekarana@ssn.edu.in

Abstract:

The quantity of solid waste society generates is constantly increasing due to industrialization and urbanization. Improper dumping and management of solid waste pollutes the surface soil, and groundwater, and causes toxicity to inhabitants. In this work, soil samples are collected from 12 locations around the dumping area of Pallikaranai to determine the activity concentration of ^{238}U, ^{232}Th and ^{40}K using NaI(Tl) detector-based gamma-ray spectrometer. The obtained results show that mean values of ^{238}U is 102±3, ^{232}Th is 46±2, and ^{40}K is 531±9 is slightly greater than the world average value. To evaluate the radiological hazard of the natural radioactivity, the radium equivalent activity Ra_{eq}, the absorbed dose rate D_R, the annual effective dose rate and the external hazard index (H_{ex}) have been calculated and compared with the internationally approved values. The study provides background radioactivity concentrations in the study area.

ICHLERA11 – 26

Gross Alpha-Beta Activities and Gamma Dose Measurements of Surface Sediments Along the North Chennai to Pondicherry coast, India

V. Sathish[1], A. Chandrasekaran[1], M. Saiyad Musthafa[2] Khalid Alzimami[3], D.A. Bradley[4,5], Mayeen Uddin Khandaker[5,6]

[1]Department of Physics, Sri Sivasubramaniya Nadar College of Engineering, Kalavakkam – 603 110 Chennai, India
[2]Unit of Research in Radiation Biology & Environmental Radioactivity (URRBER), P.G & Research Department of Zoology, The New College (Autonomous), Affiliated to The University of Madras, Chennai, Tamil Nadu 600 014, India
[3]Department of Radiological Sciences, College of Applied Medical Sciences, King Saud University, PO Box 10219, Riyadh 11433, Saudi Arabia; kalzimami@KSU.EDU.SA (KA)
[4]Department of Physics, University of Surrey, Guildford GU2 7XH, United Kingdom; d.a.bradley@surrey.ac.uk (DAB)
[5]Applied Physics and Radiation Technologies Group, CCDCU, School of Engineering and Technology, Sunway University, 47500 Bandar Sunway, Selangor, Malaysia; mayeenk@sunway.edu.my (MUK)
[6]Faculty of Graduate Studies, Daffodil International University, Daffodil Smart City, Birulia, Savar, Dhaka 1216, Bangladesh

Corresponding author's email address: chandrasekarana@ssn.edu.in

Abstract:

In this study, 21 surface sediment samples were collected from twenty-one locations along the Northeast coast of Tamil Nadu, India to measure the activity concentration of gross α, gross β, and primordial radionuclides (^{238}U, ^{232}Th, and ^{40}K) using alpha & beta counters and NaI(Tl) γ-ray detector. The mean activity concentrations were found to be 32 Bq kg^{-1} for gross α, 621 Bq kg^{-1} for gross β, 60 Bq kg^{-1} for ^{238}U, 70 Bq kg^{-1} for ^{232}Th, and 573 Bq kg^{-1} for ^{40}K. The radiological parameters were calculated for all samples and compared to assess the overall radiological profile of the sediments. The average activities of ^{238}U, ^{232}Th, and ^{40}K were higher than the world average values of UNSCEAR reports. The sediment samples' gamma dose rate and the annual effective dose equivalent exceeded the recommended safety levels. In addition, presence of radioactive minerals were confirmed by using X-ray diffraction technique. Statistical features such as frequency distribution, normality tests, and correlation of gross α and gross β were determined.

SESSION 8: RADON, THORON & DECAY PRODUCTS MEASUREMENTS

ICHLERA11 – 67

Geospatial Mapping of ^{222}Rn Risk in Malacca and Negeri Sembilan, Malaysia: Assessment of ^{222}Rn Activity Concentration in Soil Gas and Soil Permeability

N.F. Ismail[1], S. Hashim[2], and R.S. Omar[3]

[1]Radiation Safety and Health Divisian, Malaysian Nuclear Agency, 43000 Kajang, Selangor, Malaysia
[2]Department of Physics, Faculty of Science, Universiti Teknologi Malaysia, 81310 Johor Bahru, Malaysia
[3]Department of Applied Physics, Faculty of Science and Technology, Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor, Malaysia

Corresponding author's email address: fadilla@nm.gov.my

Abstract:

In this study, geogenic radon potential (GRP) mapping was carried out using field measurements of ^{222}Rn activity concentrations in soil gas and soil gas permeability, considering the area's geological formations. The study analyzed the spatial distribution of ^{222}Rn activity concentration, soil permeability, and GRP, and their relationship with geological formations through comprehensive spatial analysis. The ^{222}Rn activity concentration in soil gas ranged from Minimum Detection Activity (MDA) to 21.31 kBq m^{-3} with a mean of 1.27 ± 0.45 kBq m^{-3}. Soil gas permeability varied from 1.63×10^{-12} to 1.07×10^{-11} m^2 with a mean of $4.37 \times 10^{-12} \pm 2.53 \times 10^{-12}$ m^2. The GRP values were derived from ^{222}Rn activity concentration and soil gas permeability data, ranging from MDA to 14.49. The regions characterized by riverine alluvium soil types showed higher ^{222}Rn activity concentrations in soil and GRP, identifying them as radon-prone areas according to international standards. A GRP map, created using Kriging/Cokriging based on in situ and predicted values, highlights radon-prone areas within the study region. This GRP map is a valuable tool for assessing human health risks and planning ^{222}Rn mitigation strategies as it highlights areas with potential ^{222}Rn sources. High ^{222}Rn activity concentrations in soil typically indicate potential ^{222}Rn ingress into buildings. Therefore, soil measurements are important for assessing the radon risk in a particular area, especially for new construction. World Health Organization (WHO) recommends that the ^{222}Rn activity concentrations in indoors should not exceed 100 Bq/m³.

ICHLERA11 – 33

Radon Concentration Measurement in Domestic Water for Some Areas in Bien Hoa City Using RAD7

Truong Van Minh[1*], Nguyen Thi Hanh[2], Nguyen Van Vien[2], Dang Ba Manh[2], Tran Huy Dung[1], Le Cong Hao[3]

[1]*Faculty of Natural Science, Dong Nai University, Viet Nam*
[2] *Science and Technology Center, Dong Nai Department of Science and Technology, Viet Nam*
[3]*Faculty of Physics - Engineering Physics, University of Science-VNUHCM, Viet Nam*

Corresponding author's email address: truongminhdnu@gmail.com

Abstract:

In this study, we utilized alpha spectroscopy (RAD-7) to measure the radon concentration in 66 domestic water samples from various areas of Bien Hoa City. The findings revealed that the radon levels in the domestic water samples varied from 180 Bq/m3 to 1360 Bq/m3, with an average concentration of 437.7 Bq/m3. The average annual effective dose of radon in water through ingestion and inhalation was calculated from the experimental data to be 0.2575 mSv/y and 0.0011 mSv/y, respectively. These values were notably lower than the permissible limits recommended by the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) and the International Commission on Radiological Protection (ICRP). Additionally, the experimental results were generated using MapInfo software combined with Suffer interpolation software, depicting measured values, water sampling locations, and a color-coded distribution map of radon in water.

ICHLERA11 – 38

Study of Long-Term Behavior of Unattached ^{222}Rn Progeny Fraction in Controlled Conditions of a Walk-In Type chamber

Vijith A P[1], Rosaline Mishra[2,3], and Karunakara N[1,*]

[1]*Centre for Advanced Research in Environmental Radioactivity (CARER), Mangalore University, 574199, India*
[2]*Radiological Physics and Advisory Division, Bhabha Atomic Research Centre, Mumbai–400 094, India*
[3]*Homi Bhabha National Institute, Mumbai- 400 094, India*

Corresponding author's email address: apvijith@gmail.com

Abstract:

^{222}Rn decay products can be broadly categorized into two groups: the unattached fraction, comprising particles around 1 to 2 nm in diameter, and the attached fraction, with particles around 100 nm in diameter. The attached fraction tends to pass through the upper respiratory tract and may be expelled from the body during exhalation. On the other hand, a significant portion of the inhaled unattached fraction deposit in the alveoli of the lungs, where it undergoes somatic transport processes. Monitoring the distribution and behavior of the unattached progeny fraction in ambient air is essential for assessing the ^{222}Rn exposure. In the present study, long-term variation in the unattached fraction of ^{222}Rn progeny was examined under controlled conditions in a 22.7 m^3 walk-in type ^{222}Rn chamber at two different ^{222}Rn gas concentrations; 3000±200 Bq m^{-3} and 1000±70 Bq m^{-3}, each for a period of 5 days. Since particulate matter plays a crucial role in progeny distribution, continuous monitoring of particulate matter was also performed using applied particle technology monitors (APT-MAXIMA). The mass density of particulate matter ($PM_{2.5}$) had a maximum value of 238 µg m^{-3} after 12 h for the experiment with the ^{222}Rn concentration of 3000±200 Bq m^{-3} and decreased subsequently. In the experiment with a ^{222}Rn concentration of 1000±70 Bq m^{-3}, the maximum mass density of particulate matter was recorded after 24 h with a value of 420 µg m^{-3} and decreased thereafter. The maximum progeny concentration values recorded were 1370±11 Bq m^{-3} and 689±5 Bq m^{-3} for ^{222}Rn exposure of 3000±200 Bq m^{-3} and 1000±70 Bq m^{-3} respectively. A positive correlation between the total progeny concentration with the particulate matter concentration was observed. The ratio of unattached fraction to the total progeny concentration (p fraction) increased from 5% at 12 h to 38% at 122 h in the experiment with a ^{222}Rn concentration of 3000±200 Bq m^{-3}. In the experiment with a ^{222}Rn concentration of 1000±70 Bq m^{-3}, the p fraction increased from 2% to 25% after 24 h. A negative correlation was observed between the unattached fraction concentrations with the particulate matter concentration.

ICHLERA11 – 29

Monitoring Occupational Radiation Exposure and Safety Measures among Radiological Technologist Trainees in Malaysia: A Five-Year Experience

Muhammad Safwan Ahmad Fadzil[1]*, Nurul Elni Md Yusof[1], Wan Anwah Filzah Wan Anuar[1], Siti Hajar Zuber[1], Rozilawati Ahmad[1], Abdul Khaliq Ahmad Saparuddin[1], Norhafidzah Mohamed Sharif[1], Khadijah Mohamad Nasir[1], Noraini Ahmad Wahid[1], Nur Khalis Sukiman[1], Ahmad Bazlie Abdul Kadir[2]

[1]*Diagnostic Imaging and Radiotherapy Program, Centre for Diagnostic, Therapeutic and Investigative Studies, Faculty of Health Sciences, Universiti Kebangsaan Malaysia, 50300, Kuala Lumpur, Malaysia*
[2] *Secondary Standard Dosimetry Laboratory, Malaysian Nuclear Agency, Bangi, 43000 Kajang, Selangor, Malaysia*

Corresponding author's email address: safwanfadzil@ukm.edu.my

Abstract:

Medical radiation professionals are subject to occupational exposures and variations in workload, area of work, and types of exposure have raised concerns over possible adverse health effects. The purpose of this study is to investigate the contact hours and differences in occupational radiation exposure among radiological technologist trainees during clinical attachments in radiology and radiotherapy departments. A total of 143 trainees were monitored in terms of the effective dose Hp(10) and the skin dose Hp(0.07) across six cycles of clinical attachments in radiology and radiotherapy. Readings of 858 optically-stimulated dosimeters (OSLDs) sourced from the electronic Secondary Standard Dosimetry Laboratory database were obtained between 2017 and 2022. The mean occupational exposures of each trainee and cohort were analyzed to determine the dose distribution. The mean annually effective dose per trainee for 800 clinical contact hours in radiology was found to be 0.168 ± 0.067 mSv, whereas radiotherapy was 0.184 ± 0.076 mSv. The cumulative Hp(10) and Hp(0.07) values for clinical attachment in radiology and radiotherapy departments ranged from 0.05 - 1.30 mSv and 0.06 - 3.92 mSv, respectively. The majority of students (97% in radiology, 92% in radiotherapy) received radiation exposure doses less than 1.00 mSv. The correlation between contact hours and dose received implies that, while more time in clinical practice initially results in higher doses, effective safety standards and efficiency improvements significantly minimize exposure with time. The annual occupational radiation dose was well below the 6 mSv/year recommended limit for trainees imposed by national legislation and international standards. This data underscores the importance of a well-designed training program that balances practical experience with safety education to minimize radiation exposure to the trainees

SESSION 9: NUCLEAR POWER PLANT ACCIDENTS & RISK COMMUNICATION

ICHLERA11 – 11

Application of a Crown Ether-Functionalized Mesoporous Silica Sorbent for Radiocesium Removal from Fukushima-Originated Wastewater

Ismail M.M. Rahman[1], Rashedul Islam Ripon[2], Zinnat Ara Begum[1], Bashir Ahmmad[3]

[1]*Institute of Environmental Radioactivity, Fukushima University, 1 Kanayagawa, Fukushima City, Fukushima 960-1296, Japan*
[2]*Graduate School of Symbiotic Systems Science and Technology, Fukushima University, 1 Kanayagawa, Fukushima-Shi, Fukushima 960-1296, Japan*
[3]*Graduate School of Science and Engineering, Yamagata University, 4-3-16 Jonan, Yonezawa-shi 992-8510, Japan*

Corresponding author's email address: immrahman@ipc.fukushima-u.ac.jp

Abstract:

The decommissioning process of the Fukushima Daiichi Nuclear Power Station (FDNPS) is hindered by the accumulation of radioactive wastewater. The deliberate injection of water to cool the molten fuel in the reactor cores, along with the collection of groundwater and rainwater from the damaged facility, resulted in a substantial volume of wastewater. Following the accident, the separation of radionuclides from the cooling water was initiated, leading to the introduction of the Advanced Liquid Processing System (ALPS). ALPS was designed to remove 62 target radionuclides collectively. The ALPS-treated water has been stored in specially designed tanks near the FDNPS. The concentrations of various radionuclides of ecological concern varied considerably among the tanks, and also over 70% of the tanks would require secondary treatment to meet regulatory limits. The current study reports the development of a novel sorbent, which includes a crown-ether, di-formyl dibenzo-18-crown-6-ether (DFDB18C6), that is covalently tethered to amino-functionalized mesoporous silica (SBA-NH_2) to create a new crown ether-functionalized mesoporous silica sorbent (DFDB18C6@SBA-NH_2). The newly developed sorbent was characterized and evaluated for its efficacy in removing r-Cs from wastewater originating from the FDNPS.

ICHLERA11 – 12

Dispersant-Induced Migration of Radiocesium in Contaminated Soils: Implications for Soil Decontamination in Fukushima

Zinnat Ara Begum[1], Rashedul Islam Ripon[2], Iqbal Hossen[2], Ismail M.M. Rahman[1]

[1]*Institute of Environmental Radioactivity, Fukushima University, 1 Kanayagawa, Fukushima City, Fukushima 960-1296, Japan*
[2]*Graduate School of Symbiotic Systems Science and Technology, Fukushima University, 1 Kanayagawa, Fukushima-Shi, Fukushima 960-1296, Japan*

Corresponding author's email address: zinnat.ara@gmail.com

Abstract:

The 2011 Fukushima Daiichi Nuclear Power Plant catastrophe released a substantial number of radionuclides and contaminated the surroundings. The subsequent cleanup activities, as a part of the decontamination initiatives, resulted in an extensive volume of contaminated soils. The excavated contaminated soils have been stored in specially designed storage bags and require further treatment before disposal. This study investigates the ability of sodium hexametaphosphate (SHMP) to act as a dispersion agent, hence assisting in the volume reduction of radiocesium (r-Cs) contaminated soil. The contaminated soils from Fukushima were treated with SHMP and then sorted into distinct size fractions by wet sieving. The distribution of r-Cs and other elements in solid phases was studied. The study found that SHMP treatment effectively concentrates over 92% of r-Cs into soil-size fractions smaller than 212 µm. This discovery suggests that isolating significantly polluted smaller soil size fractions after SHMP treatment may be a viable strategy for reducing the overall volume of r-Cs contaminated soils, hence contributing to the creation of an efficient and cost-effective waste management strategy.

ICHLERA11 – 03

Radiologically Contaminated Workers at the Laguna Verde Nuclear Power Plant- MEXICO

Salas, Bernardo

Department of Physics, Faculty of Sciences, National Autonomous University of Mexico- Mexico

Corresponding author's email address: salasmarb@ciencias.unam.mx

Abstract:

Six workers suffered internal contamination from radioactive materials during refueling of Nuclear Reactor No. 1 of the Laguna Verde Nuclear Power Plant (LVNPP), which is operated by the Federal Electricity Commission (FEC). When the LVNPP was investigated, due to this irregularity, by the National Commission for Nuclear Safety and Safeguards (NCNSS) (which is the regulatory body in Mexico in nuclear matters), they found concealment of information, falsehoods, alteration of records, as can be verified in the "Inspection Report IIIE-01/18-LV01", which was obtained through the National Institute of Access to Public Information and also provided by the FEC; Because the nasal and oropharyngeal samples taken from the workers were omitted to be analyzed, as they were incorrectly discarded, only Cobalt 60 was reported as a contaminant, which prevented the identification of contaminating radionuclides that emit alpha and beta radiation. In said Inspection Report IIIE-01/18-LV01 it can be read: "This is reason for suspension of this License when the NCNSS considers that there is a significant impact on safety due to the FEC providing false information on aspects related to safety of the Plant or unfavorable factors are discovered from the point of view of Nuclear, Radiological or Physical Safety, which were not known to date". This work aims to analyze the aforementioned Inspection Report, propose a solution that allows avoiding a recurrence of its occurrence, as well as participate in the dissemination of this type of Operational Experiences, which can be classified as Bad Radiological Protection Practices that go against Safety Culture. This work was prepared in the Department of Physics of the Faculty of Sciences of the National Autonomous University of Mexico.

ICHLERA11 – 06

Radiological Risk Factors and Mineralogical Characterization of the Clay Samples Collected from Payanoor Archaeological Site, Tamil Nadu

Tamilarasi, A, Chandrasekaran A

Department of Physics, Sri Sivasubramaniya Nadar College of Engineering, Kalavakkam, Chennai - 603 110, Tamil Nadu, India

Corresponding author's email address: chandrasekarana@ssn.edu.in

Abstract:

This study concentrated on the radiological risk factor correlated with radionuclides and their daughter products enriched in environmental materials. For this radiometric research, 15 clay samples were taken near the Payanoor archaeological site of Chengalpattu district, Tamil Nadu. Evaluating radiation levels at archaeological sites and their surroundings is crucial for protecting researchers and workers during excavations. The computed mean activity concentrations of the radionuclides ^{226}Ra, ^{232}Th and ^{40}K in clay samples were 30.854 Bq kg^{-1}, 42.616 Bq kg^{-1}, and 429.15 Bq kg^{-1}, respectively. Both ^{232}Th and ^{40}K showed greater concentrations than the world recommended limit, while ^{226}Ra had a lower concentration. Various radiological parameters were computed and compared to world recommended limits in order to estimate the radiological impact for individuals. Fourier transform infrared spectroscopy (FT-IR) examination of clay samples indicated the presence of minerals such as kaolinite, montmorillonite, organic carbon, silliminite, quartz, microcline, orthoclase feldspar, calcite, sepiolite, palygorskite, and cerussite. Furthermore, the existence of minerals albite, monazite, zircon, and rutile was verified using the X-ray diffraction spectroscopy (XRD) method. Meanwhile, the Pearson correlation matrix and cluster analysis provided unique information on the relationship between radionuclide's activity and radiological parameters.

POSTER PRESENTATION ABSTRACTS

(DAY 1)

ICHLERA11 – 01

Exploring the Efficacy of High dose rate (HDR) Brachytherapy based on Ultrasound-Guided for Prostate Cancer Treatment: A Novel Approach at KFMC (Saudi Arabia)

Sarah fahad Alarwan[1], Khwolh saud Alfaraj[1], Munira Khalid Alzimami[1], Hanadi Almaslooki[1], Nawal Alqahtani[1], Saad Alrashidi, *MD FRCPC DRCPSC*[2], Mukhtar Alshanqity *PhD*[2], Abousaleh Mohamed *PhD*[2], Kholoud.S.Al-Mugren *PhD*[1*]

[1]*Physics department, medical physics program/College of Science, Princess Nourah Bint Abdulrahman University, Riyadh, Saudia Arabia*
[2]*Department of Radiation Oncology, CCC, King Fahad Medical city, Riyadh, Saudia Arabia*

Corresponding author's email address: ksalmogren@pnu.edu.sa

Abstract:

Prostate cancer remains one of the greatest health challenges globally, affecting millions of men and presenting complex challenges in diagnosis and management. The focus is on innovative treatment methods aimed at improving patient outcomes in the Kingdom of Saudi Arabia. This study begins to explore the effectiveness of ultrasound guided HDR brachytherapy for prostate cancer, introducing a new approach at King Fahd Medical City (KFMC). This study was designed comprehensively and addresses patient selection, treatment planning, and outcome evaluation as part of evaluating the therapeutic benefits of HDR brachytherapy. HDR brachytherapy is internal radiation therapy that delivers high intensity directly to the tumour site and thus reduces damage to surrounding healthy tissue. Incorporating ultrasound guidance greatly improves treatment accuracy through real-time imaging that pinpoints the position of the radiation source. The study then examines HDR brachytherapy as a standalone treatment, as well as in combination with external beam radiotherapy and as salvage after EBRT. The five cases reviewed in this study include four treated with high-dose brachytherapy, supplemented with external beam radiotherapy, and one salvage case. After six months of treatment, PSA levels were low in all four cases, and diagnostic imaging showed disease reduced. the fifth case was successfully treated and will be followed up. The study demonstrates the benefits of ultrasound guided HDR brachytherapy in the treatment of prostate cancer and the potential contribution to improved side effects and thus better treatment outcomes in more than 70% of cases. In this regard, it is an example for the region and the first time a Saudi medical team has used the latest technologies in providing health care. It also enhances the role of King Fahd Medical City, as it is a pioneer in providing advanced treatment for prostate cancer to its patients.

ICHLERA11 – 04

Identification of Alkaline and Sulphate Elements in Cement Using PGNAA Method: A Monte Carlo Simulation Approach

Marzieh Hassanpour[1*], Mohammad Rashed Iqbal Faruque[1*], Mohammadreza Rezaie[2]

[1]Space Science Centre (ANGKASA), Institute of Climate Change (IPI), Universiti Kebangsaan Malaysia, Malaysia
[2]Department of Nuclear Engineering, Faculty of Modern Sciences and Technologies, Graduate University of Advanced Technology, Kerman, Iran

Corresponding author's email address: marzieh642000@yahoo.com; rashed@ukm.edu.my

Abstract:

This study aims to investigate the feasibility of identifying alkaline and sulphate elements in cement, which significantly impact the quality and efficacy of cement in concrete construction. The analysis and identification of these elements' concentrations in cement were carried out using Prompt Gamma Neutron Activation Analysis (PGNAA). For this purpose, the geometric structure, neutron source, and appropriate gamma-ray detector were simulated using the MCNPX code. To validate the methodology, the gamma spectrum of one of the cement's constituent elements that obtained in this research by MCNPX code was compared with experimental results obtained at Brookhaven National Laboratory. Subsequently, the characteristic gamma energies associated with each element present in the cement composition were compared. Each element's unique energies, which are incompatible with each other, have been determined. Among these, those with the highest potential to transmit energies are organized as positive energies that characterize each element. After this, the detector response was recorded by changing the weight percentage of each alkaline and sulphate element in the cement and the resulting data was collected. and the relationship between the detector response and the percentage of these elements was formulated and reported. Finally, the cement spallation products resulting from neutron interactions were determined using the MCNPX code and the effects of radiation were evaluated. The results show that the radiation has no harmful effects on the user. Therefore, the PGNAA method can be considered a useful technique in determining the amount of alkaline and sulphate in cement.

ICHLERA11 – 07

Effect of Heavy Minerals on Natural Radioactivity on the Coastal Area of North Chennai to Pondicherry, India

V. Sathish[1], A. Chandrasekaran[1]

[1]*Department of Physics, Sri Sivasubramaniya Nadar College of Engineering, Kalavakkam – 603 110, Chennai, India*

Corresponding author's email address: chandrasekarana@ssn.edu.in

Abstract:

The naturally occurring radionuclides such as ^{235}U, ^{238}U, ^{232}Th, ^{40}K, and other primordial radionuclides have been present in crustal rocks since their origin. In the present study, the activity concentration of natural radionuclides ^{238}U, ^{232}Th, ^{40}K was determined using NaI(Tl) detector in sediment samples collected along the coastal area of North Chennai to Pondicherry, India and compared with world average values. To understand the elevated level of natural radionuclides, there are 13 heavy minerals namely Zircon (18.12%), Ilmenite (13.74%), Garnet (13.45%), Tourmaline (12.86%), Rutile (11.99%), Hornblende (7.02%), Sillimanite (6.89%), Kyanite (5.40%), Monazite (3.64%), Staurolite (2.30%), Epidote (1.96%), Magnetite (1.60%), and Leucoxene (1.03%) were identified and quantified in the coastal sediment samples. Pearson correlation analysis was performed to assess the effect of heavy minerals on natural radionuclides in the study area.

ICHLERA11 – 09

Natural Radioactivity and the Associated Radiation Hazards in Coal and Ash Samples Collected from Tamil Nadu, India

G. Poongodi, A. Chandrasekaran

Department of Physics, Sri Sivasubramaniya Nadar College of Engineering (Autonomous), Kalavakkam, 603 110, Chennai, Tamil Nadu, India

Corresponding author's email address: chandrasekarana@ssn.edu.in

Abstract:

In this work 21 coal and ash samples were collected from coal-based thermal power plant in the Cuddalore district of Tamil Nadu. Using a NaI(TI) γ-ray spectrometer, the activity concentration was estimated. The result carried out activity concentration of ^{238}U, ^{232}Th and ^{40}K the average mean values 51±4 Bq Kg^{-1}, 32±6 Bq Kg^{-1} and 452±12 Bq Kg^{-1}. To assess the risk associated with radionuclides, the radiological parameters were calculated. The average $ELCR_{in}$ and $ELCR_{out}$ values of the collected coal and ash samples are 3.97 $mSvy^{-1}$ and 0.51 $mSvy^{-1}$, respectively. Outdoors, excess lifetime cancer risk is 2.7 times greater than the world recommended limit of 0.29×10^{-3} $mSvy^{-1}$, whereas indoors, it is slightly higher than the global average value of 1.16×10^{-3} $mSvy^{-1}$ and the limit set by UNSCEAR. This is higher than the world average limit. These findings indicate that the excess lifetime cancer risk is high, posing a radiological risk to both the public and workers. As a result, there is an increased risk of cancer among the population residing near the coal power plant.

ICHLERA11 – 16

Assessment of Natural Radioactivity in Bricks Samples of Tamil Nadu, India using Gamma-Ray Spectrometry

Karthikayini Seenuvasan, Chandrasekaran Ananthanarayanan

Department of Physics, Sri Sivasubramaniya Nadar College of Engineering (Autonomous), Kalavakkam 603 110, Tamil Nadu, India

Corresponding author's email address: chandrasekarana@ssn.edu.in

Abstract:

The level of natural radioactivity due to primordial radionuclides ^{238}U, ^{232}Th, and ^{40}K in brick samples collected from 31 locations of Tamil Nadu were determined using gamma ray spectrometry accompanied NaI(Tl) detector. The range of measured activity concentrations of ^{238}U, ^{232}Th, and ^{40}K in brick samples were 6 to 200 Bq kg^{-1}, BDL to 765 Bq kg^{-1}, and BDL to 1171 Bq kg^{-1}, respectively. The mean activity concentrations of ^{238}U, ^{232}Th, and ^{40}K were slightly higher than the world recommended limits of 35, 45 and 420 Bq kg^{-1}, reported by UNSCEAR (2000), respectively. The radiological parameters such as annual gonadal dose equivalent (AGDE), alpha index (I_α), and gamma index (I_γ) were calculated. The mean value of AGDE was 617.52 μSv y^{-1} which is higher than the world recommended value of 300 μSv y^{-1}. However, mean values of I_α (0.34) and I_γ (0.69) were well below than the recommended levels. The findings indicate that the bricks are safe for construction purposes.

ICHLERA11 – 18

Radiological Impact of Natural Radioactivity in Malaysian Building Bricks

Azlina Baha[1,2*], S. Hashim[1,3], M.S.M. Sanusi[1] and Engku Mohd Fahmi Engku Chik[4]

[1]*Department of Physics, Faculty of Science, Universiti Teknologi Malaysia, Johor 81310, Malaysia*
[2]*Department of Physics and Material Science, Faculty of Applied Science, Universiti Teknologi MARA (UiTM), Cawangan Negeri Sembilan, Kampus Kuala Pilah, Pekan Parit Tinggi, 72000 Kuala Pilah, Negeri Sembilan, Malaysia*
[3]*Ibnu Sina Institute for Scientific and Industrial Research (ISISIR), Universiti Teknologi Malaysia, Johor 81310, Malaysia*
[4]*Kumpulan Aplikasi Penyurih Alam Sekitar (e-TAG), Bahagian Teknologi Sisa dan Alam Sekitar (BAS), Agensi Nuklear Malaysia, Bangi, 43000 Kajang, Selangor, Malaysia*

Corresponding author's email address: azlin944@uitm.edu.my

Abstract:

Indoor radionuclide exposure is significantly affected by the concentration of isotopes present in outdoor soil and building materials. Building materials derived from rocks and soils can elevate health risks for occupants due to higher radionuclide concentrations. This study aims to address this concern by evaluating the natural concentrations of radionuclides in Malaysian bricks used for construction. Gamma-ray spectroscopy with a high-purity germanium (HPGe) detector was used to determine the activity concentrations of ^{238}U, ^{232}Th and ^{40}K radionuclides, as well as the associated radiological risk hazards, in 20 brick samples collected from kiln regions across Malaysia. The mean activity concentrations of ^{238}U, ^{232}Th and ^{40}K in the brick samples were 93.95 ± 18.82 Bq kg^{-1}, 80.66 ± 15.03 Bq kg^{-1} and 693.13 ± 123.24 Bq kg^{-1}, respectively, which are well below the maximum limits recommended by ICRP Publication 142. These concentrations were used to estimate average dose rates and radiological hazard parameters. The absorbed dose rate for both indoor and outdoor exposure exceeded the internationally accepted safe limits. The mean annual effective dose (*AED*) due to indoor and outdoor exposure was 1.03 mSv y^{-1}, surpassing the acceptable safe limits. The mean of radium equivalent (Ra_{eq}), external hazard index (H_{ex}), and gamma hazard index (I_γ) were below the acceptable safe limits for building materials. Similarly, the mean of internal hazard index (H_{in}) and alpha index (I_α) were within the safe limits for bricks. Our study indicates that most of the studied samples pose minimal health risks to Malaysian occupants. This research provides baseline information from a radiological perspective on bricks and can contribute to the development of guidelines for monitoring building materials in Malaysia's construction industry.

ICHLERA11 – 23

Radiological Assessment of Sand Samples near Rooppur Nuclear Power Plant: Implications for Environmental Safety

Afroza Shelley[1*], Wayez Bin Zahid[1], M.M. Mahfuz Siraz[2], Selina Yeasmin[2], Mayeen Uddin Khandaker[3]

[1]Department of Nuclear Engineering, University of Dhaka, Bangladesh
[2]Health Physics Division, Atomic Energy Centre Dhaka, Bangladesh
[3]Applied Physics and Radiation Technologies Group, CCDCU, School of Engineering and Technology, Sunway University, Malaysia

Corresponding author's email address: shelley@du.ac.bd

Abstract:

Assessing the radioactivity in sand samples is crucial for ensuring environmental safety and public health, as it helps identify and mitigate radiation risks from both natural and artificial sources. This study marks a foundational effort to comprehensively evaluate radiation levels along the char near the Padma River, adjacent to the Rooppur Nuclear Power Plant (RNPP). The objective is to investigate the potential presence of elevated radioactivity in coastal sands, as beach placer deposits, which are rich in radioactive monazite and zircon minerals, often contain significant amounts of uranium (U) and thorium (Th). To this end, the study assessed 36 sand samples from the char near Padma river shore adjacent to the RNPP in Bangladesh, measuring their specific activities using a high-purity germanium (HPGe) detector. The specific activity of the sand samples ranged from 13±1 Bq/kg to 116±9 Bq/kg for ^{226}Ra, from 17±1 Bq/kg to 132±11 Bq/kg for ^{232}Th, and from 216±19 Bq/kg to 640±59 Bq/kg for ^{40}K. Although the specific activity of most samples was below world average values, some locations recorded values surpassing the recommendations. The assessment of hazard parameters indicates that the majority are within recommended limits; however, the peak values of outdoor and indoor absorbed dose rate (147.72, 177.26 nGy/h), annual effective dose (1.05 mSv/y), internal hazard index (1.19), and gamma level index (2.26) from one sand sample surpass recommended limits, posing significant health risks to nearby communities, seaside fishermen, and visitors. The results of this study establish important radiological baseline data before the Rooppur Nuclear Power Plant begins operating in Bangladesh in 2025, contributing to the ongoing monitoring and management of radiation safety in the region.

ICHLERA11 – 31

Study of ^{226}Ra and Dissolved Radon Activity Concentration in Ground Water Samples of Locations Around Manchanabele Reservoir, Bengaluru, Karnataka, India

Deepika D N[1], Ambika M R[2*], Karthik Kumar M B[3], Sultan J. Alsufyani[4], Bradley D A[5,6], Mayeen Uddin Khandaker[5,7], Nagaiah N[1*]

[1]*Department of Physics, Bangalore University, JB Campus, Bengaluru-560056, India*
[2]*Department of Physics, M S Ramaiah Institute of Technology, Bengaluru-560054, India*
[3]*Department of Physics, Don Bosco Institute of Technology, Bengaluru-560085, India*
[4]*Department of Physics, College of Science, Taif University, P.O.Box 11099, Taif 21944, Saudi Arabia*
[5]*Applied Physics and Radiation Technologies Group, CCDCU, School of Engineering and Technology, Sunway University, Bandar Sunway 47500, Selangor, Malaysia.*
[6]*School of Physics and Mathematics, University of Surrey, Guildford, GU2 7XH, United Kingdom*
[7]*Faculty of Graduate Studies, Daffodil International University, Daffodil Smart City, Birulia, Savar, Dhaka-1216, Bangladesh*

Corresponding author's email address: nagaiahn@rediffmail.com; mr.ambika01@gmail.com

Abstract:

Water is one of the most valuable natural resources in the environment, which is the basic need of all living beings to survive on this earth. Drinking water sources are contaminated due to the dissolution of salts, minerals, soil and radioactive materials. The most prevalent radioactive elements found in rocks, soil, concrete, air and water are ^{238}U, ^{226}Ra and ^{222}Rn. Radium (^{226}Ra) is known to be one of the most toxic long-lived radioactive elements in the environmental matrix. Radon content in groundwater sources depend on the radium concentration in the rock of the aquifer. The ingestion of water with higher levels of dissolved radon may enhance the risk of stomach and gastrointestinal cancer. Both ^{226}Ra and ^{222}Rn are the important radionuclides from the radiological significance and hence measurement of their concentrations in drinking water are found to be very important. In the present study, the activity concentrations of radium and dissolved radon in the groundwater samples of the areas around the Manchanabele reservoir, Bengaluru, Karnataka state, India have been measured using a well calibrated HPGe gamma ray spectrometer and RAD7-an active radon detection system respectively. The activity concentration of radium is found to range from 0.05±0.0 to 0.88±0.02 Bq/L with GM of 0.17±0.005 Bq/L and are well below the guideline value of 1 Bq/L. The dissolved radon concentration is found to range from 4.7±1.9 Bq/L to 625.8±47.8 Bq/L with GM of 38.3±12.7 Bq/L. The annual effective dose due to ingestion of radon was estimated for different age groups like adults, children & infants. The study shows that, about 91% of the groundwater samples show higher radon activity concentration (>11.1 Bq/L) and most of the ground water samples impart the annual effective dose higher than the recommended value of 100 µSv/y as suggested by WHO. The physicochemical parameters like pH, TDS and conductivity were also measured and dependence of activity concentration of radium and dissolved ^{222}Rn on these parameters has been studied. Using the mean value of dissolved radon activity concentration, an attempt has also been made to compute the effective doses imparted to different organs and tissues of the human body. The result showed that stomach and small intestine receive greater effective dose compared to other organs.

ICHLERA11 – 35

Suggesting a Photon Energy Discriminating Method Using a Radioluminescence Dosimetry System: Application to Workplace and Environmental Monitoring

Farhad Moradi[1], David Bradley[2,3], Hairul Azhar Abdul Rashid[1]

[1]*Fiber Optics Research Center, Faculty of Engineering, Multimedia University, Jalan Multimedia, 63100, Cyberjaya, Malaysia*
[2]*Applied Physics and Radiation Technologies Group, CCDCU, Sunway University, 46150 PJ, Malaysia*
[3]*School of Mathematics and Physics, University of Surrey, Guildford, GU2 7XH, UK*

Corresponding author's email address: moradifarhad@ymail.com

Abstract:

Area monitoring, including environmental and workplace radiation surveillance, is essential in settings with significant radiation exposure such as medical and industrial radiology, nuclear reactors, research facilities, and contaminated waste sites. Photon energies in these environments typically range from 20-30 keV to several MeV, requiring accurate dosimetry dependent on photon energy discrimination. Monitoring naturally occurring radioactive materials (NORM) and radiation in nuclear accidents also necessitates photon energy discrimination to assess exposure and implement protective measures. This study explores the feasibility of using a real-time radioluminescence (RL) fiber dosimetry system for photon energy discrimination. The system includes multiple RL sensors with various filtrations, connected to transmission fibers and photodetector device. The primary scintillator is a 2 cm length, 1 mm diameter silica fiber doped with 5% Cerium, selected for its sensitivity and energy-dependent response. Monte Carlo simulations with the TOPAS/Geant4 code model the RL sensor and design filter combinations for energy discrimination, following ISO 4037 recommendations. The Low Air Kerma Rate Series serves as the reference photon spectra, and dosimeter responses to various radiation qualities are evaluated relative to the ^{137}Cs reference photon energy. Simulation results suggest that a combination of RL scintillators and filters can enable photon energy discrimination and calculate both shallow and deep components of ambient dose equivalent ($H^*(0.07)$ and $H^*(10)$). The designed real-time RL dosimetry system can enhance the precision of radiation measurements in diverse workplace settings, contributing to safer working conditions and better environmental protection.

ICHLERA11 – 36

Radiation Hazards and Effective Dose Evaluation: A Study of Various Imported Walnut Consumed in Kurdistan-Iraq

Halmat Hassan[1,2*], Suhairul Hashim[2,3]

[1]*Department of Physics, College of Education, University of Sulaimani, Sulaimani, 46001, Kurdistan-Iraq*
[2]*Department of Physics, Faculty of Science, Universiti Teknologi Malaysia, Johor 81310, Malaysia*
[3]*Ibnu Sina Institute for Scientific and Industrial Research (ISISIR), Universiti Teknologi Malaysia, Johor 81310, Malaysia*

Corresponding author's email address: Halmat.hassan@univsul.edu.iq

Abstract:

The investigation is made of 35 commercially available walnut samples containing naturally occurring radioactive material. The samples are available in Kurdistan Region-Iraq large retailers, including local and imported products. Assessment is made of the radiological risk posed by consuming walnuts, internal exposure dose being the particular focus. Gamma spectroscopy analysis (HPGe) and XRF spectrometer are used. For ^{238}U, ^{232}Th, and ^{40}K the walnut sample, code W13 (originally from the USA), was found to contain the greatest activity, at 33.8 ± 4.1, 76.7 ± 6.24, and 583.8 ± 64.3 Bq kg^{-1} respectively; least was for the walnut sample, code W18 (originally from China), at respective values 1.54 ± 0.03, 7.732 ± 1.2 and 38.85 ± 5.63 Bq kg^{-1}. The average concentration of radioactivity fell within the accepted range of values worldwide by UNSCEAR, at 33, 45, and 412 Bq kg^{-1}. for ^{238}U, ^{232}Th, and ^{40}K, respectively). In terms of elemental concentration, sample W13 offered the greatest concentration, with mean percentages of 0.00037 ± 0.0001 and 0.002 ± 0.0011, for U and Th, respectively. With the assumption of the annual intake of walnut at 1.5 kg for the child (10 years old) and 11 kg for adults, consuming the walnut W13 would give rise to an annual effective dose of 0.38 mSv below the public annual dose limit of 1 mSv. Overall, the data collected from these measurements establish a new baseline for radiological information, enabling an assessment of potential health risks associated with prolonged exposure to radioactivity in these foodstuffs.

ICHLERA11 – 40

Radiological Impact Assessment of Fly Ash Utilization in Vietnamese Construction: A Case Study on NORM

Sy Minh Tuan Hoang[1]

[1]*Thu Dau Mot University, 6 Tran Van On, Phu Hoa Ward, Thu Dau Mot City, Binh Duong, Vietnam, 820000.*

Corresponding author's email address: hoangsyminhtuan@tdmu.edu.vn

Abstract:

The utilization of fly ash as a supplementary cementitious material in concrete is increasing in Vietnam. However, fly ash contains naturally occurring radioactive materials (NORM), which can pose a radiological risk to humans. This study investigates the radiological impact of fly ash utilization in Vietnamese construction by quantifying the activity concentrations of ^{226}Ra, ^{232}Th, and ^{40}K in fly ash samples from six coal-fired power plants. The resulting radiation doses in various building scenarios are assessed, considering both external gamma radiation and internal radon exposure. The associated radiological risks are evaluated, and the findings are compared with international standards. The results indicate that some fly ash samples exhibit elevated levels of NORM, leading to radiation doses exceeding recommended limits in certain building configurations. The study underscores the importance of pre-use assessment and careful selection of fly ash sources to ensure radiation safety in construction. The findings provide valuable insights for policymakers and industry stakeholders to develop informed strategies for the safe and sustainable utilization of fly ash in the Vietnamese construction industry.

ICHLERA11 – 42

Predicting Radioactive Material Dispersion from the Zaporizhzhia Nuclear Power Plant Using LSTM and RNN Models

Mehdi Hassanpour[1,*], Mohammadreza Rezaie[2], Javad Tayebi[2], Marzieh Hassanpour1, Mohammad Rashed Iqbal Faruque[1,*], Mayeen Uddin Khandaker[3,4]

[1]*Space Science Centre (ANGKASA), Institute of Climate Change (IPI), Universiti Kebangsaan Malaysia, Malaysia*
[2]*Department of Nuclear Engineering, Faculty of Modern Sciences and Technologies, Graduate University of Advanced Technology, Kerman, Iran*
[3]*Applied Physics and Radiation Technologies Group, CCDCU, School of Engineering and Technology, Sunway University, Bandar Sunway, Selangor 47500, Malaysia*
[4]*Faculty of Graduate Studies, Daffodil International University, Daffodil Smart City, Birulia, Savar, Dhaka 1216, Bangladesh*

Corresponding author's email address: mhassanpour67@yahoo.com; p109951@siswa.ukm.edu.my; rashed@ukm.edu.my

Abstract:

The scientific study under discussion examined the predictive modelling of radioactive material dispersion pathways in the event of a hypothetical incident at the Zaporizhzhia Nuclear Power Plant with high precision. The study utilized data from the United States National Oceanic and Atmospheric Administration (NOAA) and The Hybrid Single-Particle Lagrangian Integrated Trajectory model (HYSPLIT) software to forecast trajectory zones and environmental variables, such as altitude, temperature, and humidity, for the period from February 1 to February 7, 2024. The predictions were further enhanced by employing a Long Short-Term Memory (LSTM) neural network, which extended the forecast for an additional week beyond the study period. These predictions were then evaluated against actual data from the following week. The model's accuracy was rigorously assessed using statistical metrics, including Mean Absolute Error (MAE), Root Mean Square Error (RMSE), Mean Absolute Percentage Error (MAPE), Mean Relative Error (MRE), and Mean Bias Error (MBE). The results of this research have significant potential to improve crisis management protocols and to develop robust countermeasures in anticipa tion of similar events.

ICHLERA11 – 52

Simulation and Risk Assessment of Radiological Dispersal Device (RDD) Attacks in Major Southeast Asian Cities using HYSPLIT Modelling

Amirul Fakhrudin[1], Lokman Hakim Muhammad[1], Muhammad Khalis Abdul Karim[1*], Sharudin Omar Baki[1]

[1]*Department of Physics, Universiti Putra Malaysia, Malaysia*

Corresponding author's email address: mkhalis@upm.edu.my

Abstract:

Terrorist attacks pose a significant security threat, particularly in developing regions such as Southeast Asia. The possibility of terrorists acquiring radionuclides and developing a radiological dispersal device (RDD) highlights the urgent need for a comprehensive emergency response plan. This study examines the dispersion of radionuclides following a hypothetical terrorist attack in selected cities across Southeast Asia, specifically Kuala Lumpur (3.14° N, 101.71° E) in Malaysia, Jakarta (6.21° S, 106.85° E) in Indonesia, and Bangkok (13.75° N, 100.50° E) in Thailand. The primary aim is to analyse the dose concentration of radionuclides released by an RDD over a 24-hour period and assess the associated health risks, including morbidity and mortality rates per 100,000 people. The Hybrid Single-Particle Lagrangian Integrated Trajectory (HYSPLIT) model was used to simulate the dispersion and trajectory of radionuclide particles in the atmosphere. This study focused on Cesium-137 (Cs-137) with an activity level of 50 TBq. The results revealed air dose concentrations of 3.3 mSv, 1.8 mSv, and 7.7 mSv, and ground dose depositions of 150 mSv, 71 mSv, and 310 mSv in Kuala Lumpur, Jakarta, and Bangkok, respectively, within the first 24 hours. The analysis showed that dose concentrations were most critical during the initial four hours following the Cs-137 release, with peak levels occurring between 30 and 90 minutes at an altitude of 60 to 80 meters. Risk assessment from inhalation exposure suggested that, per 100,000 residents, 88 fatalities and 128 injuries could occur if individuals were exposed at the critical altitude during the 45 to 60-minute period after dispersion. These findings underscore the need for rapid and effective governmental action to mitigate the impact of such an attack. This study provides essential insights for improving radioactive waste management practices and developing protocols to counter potential RDD threats, thereby enhancing public safety across Southeast Asia.

POSTER PRESENTATION ABSTRACTS

(DAY 2)

ICHLERA11 – 32

Computation of Dose Distribution in Brain for Very High Energy Electron Radiotherapy

Marziyeh S. Kazemi[1], Dariush Sardari[1], Elham Saeedzadeh[1], Ali Taheri[2], Ali J. Nazari[3]

[1]*Department of Medical Radiation Engineering, Science and Research Branch, Islamic Azad University, Tehran, Iran*
[2]*Applied Physics and Radiation Technologies group, CCDCU, Sunway University, Malaysia*
[3]*Department of Biomedical Engineering, Semnan Branch, Islamic Azad University, Semnan, Iran*

Corresponding author's email address: dariush.sardari@gmail.com

Abstract:

The application of high-energy electrons (HEE) with energies ranging from 6-25 MeV is well-established in radiation treatment. Recently, the use of HEE in FLASH radiotherapy has been explored. Meanwhile, very high-energy electrons (VHEE) with energies ranging from 50-250 MeV are being investigated in preclinical stages. This study computes the dose distribution in the brain upon VHEE exposure using Monte Carlo simulations, considering the presence of the skull bone. The interaction of energetic electrons with bone, which contains elements with higher atomic numbers such as calcium and phosphorus, produces secondary X-rays that modify the electron dose distribution. This combined dose distribution accounts for both the direct impact of the electrons and the effects of the X-rays, providing a more comprehensive understanding of the radiation dose delivered to the tissue. The study examines 25 MeV and 50 MeV electrons with beam diameters of 1 cm and 2 cm, offering insights into optimizing treatment parameters for effective tumor targeting according to the size and depth of tumor.

ICHLERA11 – 41

Environmental Radiation Monitoring in Northern Vietnam: Baseline Data for Transboundary Radiation Risk Assessment

Sy Minh Tuan Hoang[1]

[1]*Thu Dau Mot University, 6 Tran Van On, Phu Hoa Ward, Thu Dau Mot City, Binh Duong, Vietnam, 820000*

Corresponding author's email address: hoangsyminhtuan@tdmu.edu.vn

Abstract:

The increasing reliance on nuclear power globally, coupled with the proximity of Vietnam to operational and planned nuclear facilities in neighboring countries, necessitates robust environmental radiation monitoring. This study investigates gamma dose rates in air and the activity concentrations of ^{238}U, ^{232}Th, and ^{40}K in soil and sediment samples collected from some provinces in northern Vietnam. The measurements adhere to Vietnamese national standards, utilizing calibrated instruments and rigorous analytical methods. Results reveal that the gamma dose rates and radionuclide activity concentrations are within the normal range, consistent with previous studies and global averages. The spatial distribution of these parameters highlights regional variations, influenced by factors such as geological formations and agricultural practices. The data generated in this study contribute to the development of a national environmental radiation database, crucial for assessing transboundary radiation risks and establishing effective early warning systems in Vietnam.

ICHLERA11 – 45

Validation of a Radiation Discrimination Technique for Mixed Neutron–Photon Fields Involving the Use of a Tissue Equivalent Counter

Chih-Chien Nieh[1,4], Fang-Yuh Hsu[2,3*], Rong-Jiun Sheu[1], and Hsiu-Hui Chou[5]

[1]*Institute of Nuclear Engineering and Science, National Tsing Hua University, Hsinchu, Taiwan ROC.*
[2]*Department of Biomedical Engineering and Environmental Sciences, National Tsing Hua University, Hsinchu, Taiwan ROC.*
[3]*Nuclear Science and Technology Development Center, National Tsing Hua University, Hsinchu, Taiwan ROC.*
[4]*Nuclear Safety Commission, New Taipei City, Taiwan ROC.*
[5]*West Garden Health Care Group West Garden Hospital, Taipei, Taiwan ROC.*

Corresponding author's email address: fyhsu@mx.nthu.edu.tw

Abstract:

The present study evaluated microdose energy deposition parameters and dose equivalents of mixed photon and neutron radiation using a tissue equivalent proportional counter (TEPC) to verify a method to differentiate dose in mixed radiation fields; particles and heavy ions were then used The Transmission Code System (PHITS) validated the method through simulations. The results of dose verification using a neutron and photon mixed radiation plant produced by Cf-252 show that the radiation identification technology based on TEPC can distinguish the micro-dose energy spectrum of different LET radiation and produce a distribution trend consistent with the PHITS simulation. Furthermore, the TEPC-based technique used in this study can further distinguish the photon, the lower energy (thermal) neutron and the higher energy (above-thermo) neutron radiation in mixed fields, thereby improving the monitoring capabilities of radiation component analysis and dose assessment.

ICHLERA11 – 46

Natural Radioactivity in Cement: An Assessment of Construction Materials in Ho Chi Minh City

Sy Minh Tuan Hoang

Tran Van On, Phu Hoa Ward, Thu Dau Mot City, Binh Duong, Vietnam, 820000.

Corresponding author's email address: hoangsyminhtuan@tdmu.edu.vn

Abstract:

The increasing use of cement in construction has raised concerns about the potential impact of natural radioactivity in building materials on human health. The study addresses these concerns by measuring the levels of natural radioactivity in 42 cement samples collected from various sources in Ho Chi Minh City (Vietnam). The study utilizes a low-background gamma spectrometer to determine the activity concentrations of U-238, Th-232, Ra-226, and K-40. The obtained results reveal that the activity concentrations of these radionuclides are well within the safety limits stipulated by Vietnamese standards. The study also evaluates radiation hazard indices, including the radium equivalent activity and the external hazard index, further confirming the safety of the cement samples for construction purposes. The research underscores the significance of continuous monitoring and regulation of natural radioactivity in building materials to safeguard the well-being of building occupants. The findings offer valuable insights for policymakers, researchers, and the construction industry in Vietnam and beyond, contributing to a deeper understanding of the implications of natural radioactivity in the built environment.

ICHLERA11 – 47

Mapping the Airborne Distribution of Caesium-137 in the Asia Pacific Region Using Data from the Comprehensive Nuclear Test-Ban Treaty

Azni Abdul Aziz[1], Ahmad Ibraheem Abu Bakar[1], Bashillah Baharuddin[2], Mohamad Syahiran Mustaffa[2]

[1]*Department of Physics, International Islamic University Malaysia, 25200 Kuantan, Pahang, Malaysia*
[2]*Malaysian Nuclear Agency, Bangi, 43000 Kajang, Selangor, Malaysia*

Corresponding author's email address: azniabdulaziz@iium.edu.my

Abstract:

Recent global events, such as North Korea's nuclear tests and the Fukushima nuclear accident, have heightened concerns about the dispersion of radioactive materials into the atmosphere. This study maps the dispersion of airborne Cs-137 in the Asia Pacific region, with a focus on its impact on the Malaysian environment. Cs-137 concentration data were collected from the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO) radionuclide online database, covering the Northeast and Southwest Monsoon seasons from 2009 to 2023. The data, sourced from 12 International Monitoring System (IMS) stations across the Asia Pacific, Central Asia (China), and Australia, were analyzed using ArcGIS Pro software to create maps illustrating the spread of Cs-137 for each season of the selected years. The maps reveal the atmospheric distribution of Cs-137 over time, with the highest concentration recorded at 2985.02 μBq/m3 at Japan's JPP38 station in March 2011, following the Fukushima nuclear disaster. Generally, the dispersion shows an outward pattern within the region, but it gradually diminishes, returning to a very low concentration of less than 10 μBq/m3 as the years approach 2023.

ICHLERA11 – 49

Comparison of Absorbed Dose Measurement Using Fabricated Germanium Doped Optical Fibres, NanoDot OSLD and TLD-100 in High Radiation Level

N. Abdullah[1,2], N. Mohd Noor[1,3,*], Z. Kamarul Zaman[4], M. Mohammad Zahid[5], J.M. Wahabi[5]

[1]*Medical Physics Laboratory, Department of Radiology, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, 43400 Serdang, Selangor, Malaysia*
[2]*Medical Physics Laboratory, Radiation Metrology Group, Malaysian Nuclear Agency, 43000 Kajang, Selangor, Malaysia*
[3]*Medical Physics Unit, Hospital Sultan Abdul Aziz Shah, Universiti Putra Malaysia, 43400 Serdang, Selangor, Malaysia*
[4]*Department of Medical Physics, University of Malaya Medical Centre, 59100 Kuala Lumpur, Malaysia*
[5]*Department of Radiotherapy and Oncology, National Cancer Institute, 62250 W.P. Putrajaya, Malaysia*

Corresponding author's email address: noramaliza@upm.edu.my

Abstract:

Introduction: Accurate measurement of the absorbed dose in high-radiation environments is crucial for the protection of human health, optimisation of medical treatments, and safety of radiation workers. **Methodology:** This study assessed the absorbed dose from two types of Germanium-doped optical fibres (GedoFs), namely cylindrical (CGedOF) and flat (FGedOF) shapes, in comparison to commonly used gold standard detectors, namely LiF:Mg,Ti (TLD-100), and Al_2O_3:C (nanoDot OSLD). Prior to the measurement of the absorbed dose, the dosimetric characteristics of each detector were evaluated using Cobalt-60 (^{60}Co), 6 and 10 MV photon beams, and 6 and 9 MeV electron beams to establish relevant correction factors. **Results & Discussion:** This evaluation revealed an excellent linear-response relationship among all detectors for the dose range of 1 to 3 Gy, with a minimum determination coefficient of 0.998. The sensitivity of the response increased consistently with the dose delivered, except for GedOFs. At lower beam energies, the sensitivity of both GedOF types diminished, which requires further investigation. All detectors displayed readout reproducibility, with a variation of less than 2.3%. At 70 days post-irradiation, CGedOF (24.7%) exhibited the highest signal fading, followed by TLD-100 (15.4%), FGedOF (10.7%), and nanoDot OSLD (3.2%). All detectors showed dose rate independence, with a measurement uncertainty of less than 1.7% at 2 to 6 Gy/min. In comparison to ^{60}Co, all detectors appeared to be energy-dependent, except TLD-100. The estimated expanded uncertainties of the absorbed dose measurement for all detectors were estimated to be between 1.80% and 2.33%, with a coverage factor of $k = 1$. **Conclusions:** Our findings confirm the reliability of all tested detectors for accurate absorbed dose measurements in high radiation environments, highlighting potential improvements for radiation safety and medical treatment optimisation.

ICHLERA11 – 50

Algerian Soil and Phosphate Sample Radioactivity Levels and the Associated Radiological Risk Index Assessment

Abdelfettah Belafrites

Laboratoire de Physique de Rayonnement et Applications (LPRA)
Department of Physics, University of Jijel, BP 98, Ouled Aissa, Jijel, Dz-18000, Algeria

Corresponding author's email address: belafrites@univ-jijel.dz

Abstract:

Fine measurements of low radioactivity by gamma spectrometry require optimization of the detection geometry and knowledge of the gamma line level scheme. Thus, it is possible to increase the counting rate and consequently reduce the statistical uncertainty of the spectral peaks exploited for the quantification of radioelements by bringing the sample as close as possible to the detector. However, increasing the volume of the sample requires a correction of the self-absorption of the emissions for the sample itself, and the proximity of the detector is at the origin of the peak-sum phenomenon. In a dosimetry application, geological samples of raw material deposits, namely phosphates and their byproducts, as well as some soil samples were analyzed by gamma spectrometry. ^{238}U, ^{232}Th, ^{40}K and ^{137}Cs have been identified and corrected for the effects mentioned above. The dosimetry of their gamma radiation made it possible to evaluate the radiological risk indices, the absorbed dose and the annual effective dose received from these materials. The results obtained are within the regulatory limits prescribed by UNSCEAR.

ICHLERA11 – 54

Distribution of Uranium in Groundwater of Tarn-Taran district of Punjab and Its Remediation using $NdFeO_3$ Perovskite

Nisharika Arya[1], Mayeen Uddin Khandaker[2], B S Bajwa[3], Inderpreet Kaur[4], Anupinder Singh[3], Sunil Kumar[3], Nitin Tandon[1]* and Satvir Singh[1]*

[1]Department of Applied Sciences, CT University, Ludhiana,142024, India
[2]Applied Physics Radiation Technologies Group, CCDCU, School of Engineering and Technology, Sunway University, 47500, Malaysia
[3]Department of Physics, Guru Nanak Dev University, Amritsar,143005, India
[4]Department of Chemistry, Guru Nanak Dev University, Amritsar,143005, India

Corresponding author's email address: singhsatvir1994@gmail.com

Abstract:

High prevalence of uranium in a region may pose radiological & chemical toxicity, which can cause severe health problems associated with kidney, brain, liver etc to inhabitants of the region. Thus, a systematic monitoring of uranium concentration and development of efficient remediation strategies has gained immense attention. Considering this background, present study was carried out to assess the uranium contamination in groundwater of Tarn Taran District of Punjab, India. The uranium concentration in the collected groundwater samples has been varied from 0.7 µg/L – 144.2 µg/L. It has been found that around 38 % of groundwater samples were having higher uranium concentration than the WHO (2011) recommendation of 30 µg/L. It has also been observed that the shallow groundwater has high uranium concentration, and it decreases with the depth profile. The significant correlation of Uranium was observed with TDS, TA, Hardness and major ions such as Cl^-, F^-, SO_4^{2-}, PO_3^{4-} indicating its existence in the form of various ionic complexes in the groundwater which may influence the its mobilization. In the present work, $NdFeO_3$ perovskite were synthesized following a solid-state reaction route and further characterised using X-ray diffraction, FT-IR, FE-SEM, EDX for their structural, functional and surface features. The prepared perovskite was found to perform best at optimum adsorption parameters: pH (6), adsorbent dose (0.4 g/L) and contact time (30 min). The maximum Langmuir adsorption capacity (mg/g) of $NdFeO_3$ was 156.23 mg/g. These prepared perovskite was found to act as efficient and effective adsorbent for treatment of uranium contaminated groundwater samples of Tarn-Taran district.

ICHLERA11 – 56

Novel Fabricated Germanium-doped Optical Fibres as High Absorbed Dose Measurement Detector for Mapping Gamma-ray Cesium-137

Ku Shaidaton Akmar Ku Bakar[1], Noramaliza Mohd Noor[1,2], Faridah Ismail[3]

[1]Medical Physics Laboratory, Department of Radiology, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, 43400 Serdang, Malaysia
[2]Medical Physics Unit, Hospital Sultan Abdul Aziz Shah, Universiti Putra Malaysia, 43400 Serdang, Selangor, Malaysia
[3]Department of Pathology, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, 43400 Serdang, Malaysia

Corresponding author's email address: noramaliza@upm.edu.my

Abstract:

Measurement of radiation absorbed dose is crucial for assessing potential biological harm to living tissues, ensuring safety and precision in dose delivery to human tissue. TA-GVH disease is a prevalent complication of blood transfusion. The dose mapping method ensures that the radiation dose to the blood remains within the predetermined limits set by authorities up to 50Gy. This study aims to explore the possibilities of using fabricated Ge-doped optical fibre dosimeters as a radiation dose mapper for quality assurance (QA). Two types of fabricated 2.3mol% Ge-doped optical fibres were used, cylindrical (CF) and flat (FF), calibrated within a high dose range of 5 to 50Gy using a Cobalt-60 machine at the SSDL, Nuclear Malaysia Agency. Dose mapping was conducted in a Cesium-137 source blood irradiator at the Pathology Department, HSAAS, using blood-equivalent phantom to gamma radiation of 25Gy and comparing thermoluminescence (TL) signals with EBT-XD film. The result showed no significant difference ($p > 0.05$) in mean absorbed dose between the both optical fibres and EBT-XD film. Both fibres exhibited a mean error of 4%, and EBT-XD film was 3.4%, indicating good agreement with the nominal dose value of 25Gy. High radiation exposure can be accurately monitored and assessed using a dosimetry method, such as Ge-doped optical fibre dosimetry. This passive dosimeter offers high sensitivity, cost-effectiveness, and reusability, making it a valuable alternative to conventional blood dosimetry. Comprehensive dose mapping allows for precise monitoring and evaluation of the radiation field, ensuring accurate assessment of radiation exposure in high-dose radiation environments.

ICHLERA11 – 57

A Trial Run of Passive Radiation Monitoring using Fabricated Germanium-doped Silica Optical Fibres Personal Dosimeter Badge (SOFPeD) in High Radiation Environments

N. Mohd Noor[1,2,*], M. F. Hassan[1], N. Tamcheck[3], M. A. Mahadi [4], H. A. Abdul Rashid[5], M.R. Rifiat[6]

[1]*Medical Physics Laboratory, Department of Radiology, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, 43400 Serdang, Selangor, Malaysia*
[2]*Medical Physics Unit, Hospital Sultan Abdul Aziz Shah, Universiti Putra Malaysia, 43400 Serdang, Selangor, Malaysia*
[3]*Department of Physics, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, 43400 Serdang, Selangor, Malaysia*
[4]*Department of Computer System Engineering and Communication, Universiti Putra Malaysia, 43400 Serdang, Selangor, Malaysia*
[5]*Fibre Optics Research Centre, Faculty of Engineering, Multimedia University, 63100 Cyberjaya, Malaysia*
[6]*Alypz Sdn Bhd, Taman Perindustrian USJ 1, 47600 Subang Jaya, Selangor*

Corresponding author's email address: noramaliza@upm.edu.my

Abstract:

Introduction: This study presents a trial run of passive radiation monitoring employing novel Germanium-doped silica optical fiber personal dosimeter badges (SOFPeD) designed for high radiation environments. Methodology: The SOFPeD badges were fabricated to leverage the sensitivity of Germanium-doped silica optical fibers, aiming to provide accurate and reliable dose measurements in conditions with elevated radiation levels. The trial involved deploying these dosimeter badges in various high-radiation settings to assess their performance, stability, and effectiveness in real-clinical scenarios. Key parameters evaluated included dose sensitivity, accuracy of radiation measurements, and the operational robustness of the badges under intense radiation exposure. Results & Discussion: Preliminary results indicate that the SOFPeD badges offer a promising approach for passive radiation monitoring, with potential benefits in enhancing safety protocols and improving dose assessment accuracy in radiological environments. Conclusions: This research highlights the advantages of using optical fiber technology in personal dosimetry and sets the stage for further development and optimization of radiation monitoring tools.

ICHLERA11 – 62

Optimizing CT Dose Accuracy and Patient Safety: A Comparative Evaluation Across Five Scanner Models in Malaysian Hospitals

R. S. Omar[1], S. Hashim[2], D.A. Bradley[3] and N. D. Shariff[4]

[1]*Department of Applied Physics, Faculty of Science and Technology, Universiti Kebangsaan Malaysia, 43600 UKM Bangi, Selangor, Malaysia.*
[2]*Department of Physics, Faculty of Science, Universiti Teknologi Malaysia, 81310 Johor Bahru, Malaysia.*
[3]*Centre for Applied Physics and Radiation Technologies, School of Engineering and Technology, Sunway University, Malaysia.*
[4]*Hospital Sultanah Aminah, Johor Bahru, 80100, Malaysia*

Corresponding author's email address: ratna@ukm.edu.my

Abstract:

This study explores the implementation of standardized computed tomography (CT) test parameters used in quality control (QC) protocols across five multi-detector computed tomography (MDCT) scanner models in selected hospitals in Malaysia. The study aims to improve dose estimation accuracy and reduce radiation risks to patients undergoing CT examinations by addressing concerns regarding inconsistencies in standard CT dosimetry practices. The CT scanners evaluated represent a range of manufacturers and models, including Toshiba (Aquilion One), Philips (Brilliance CT Big Bore), Siemens (Somatom Definition AS+), General Electric (LightSpeed VCT), and Neusoft (NeuViz 64e). The QC tests focused on eight key areas: (1) scan localization accuracy, (2) X-ray generator performance, (3) radiation dosimetry, (4) image display quality, (5) hard copy output fidelity, (6) quantitative accuracy, (7) overall image quality, and (8) scattered and leakage radiation. Each QC test was conducted according to established protocols, with data recorded and analyzed to determine whether the scanners adhered to the standardized parameters. The comparison between different manufacturers and models revealed that all evaluated parameters met the optimal performance standards set by the QC protocols. The findings showed that scan localization was consistently accurate across all models, X-ray generator performance remained stable, and radiation dosimetry results fell within the acceptable dose ranges. Additionally, image display quality and hard copy outputs were high fidelity, while quantitative accuracy and overall image quality metrics demonstrated minimal variance. Scattered and leakage radiation levels were also well within the safety thresholds. Overall, the study confirms that standardized QC protocols effectively ensure the consistent performance of MDCT scanners across different models and manufacturers, thus contributing to safer clinical practices and better patient outcomes in CT examinations. These findings underscore the importance of rigorous QC measures in maintaining high diagnostic imaging and radiation protection standards.

POSTER PRESENTATION ABSTRACTS

(DAY 3)

ICHLERA11 – 44

PGNAA Analysis of Sediments from Garab Hot Spring in Behbahan, Iran and Assessment of Radiation Hazards of Present Radioactive Elements

Mehdi Hassanpour[1,*], Mohammadreza Rezaie[2], Marzieh Hassanpour[1], Javad Tayebi[2], Mohammad Rashed Iqbal Faruque[1,*], Mayeen Uddin Khandaker[3,4]

[1]*Space Science Centre (ANGKASA), Institute of Climate Change (IPI), Universiti Kebangsaan Malaysia, Malaysia.*
[2]*Department of Nuclear Engineering, Faculty of Modern Sciences and Technologies, Graduate University of Advanced Technology, Kerman, Iran*
[3]*Applied Physics and Radiation Technologies Group, CCDCU, School of Engineering and Technology, Sunway University, Bandar Sunway, Selangor 47500, Malaysia*
[4]*Faculty of Graduate Studies, Daffodil International University, Daffodil Smart City, Birulia, Savar, Dhaka 1216, Bangladesh*

Corresponding author's email address: mhassanpour67@yahoo.com; p109951@siswa.ukm.edu.my; rashed@ukm.edu.my

Abstract:

Radiation hazards in any region depend on the activity levels of radioactive elements such as ^{232}Th, ^{137}Cs, ^{40}K, and ^{238}U. The sediments of the Garab Hot Spring in Behbahan, Iran, which are used for therapeutic purposes, may pose radiation risks to users due to the presence of these radioactive elements. To measure the radiation hazards of the sediments from this spring, samples were collected from three different locations: around the spring, within the spring itself, along the flow path, within the pool, and from the surrounding soil to calculate the activity levels. After calculating the activity, various radiation hazard parameters, including Ra_{eq}, D_Y, D_{out}, D_{in}, D_{tot}, H_{ex}, H_{in}, I_y, and ELCR, were measured. The results indicate that the radiation hazards are below permissible limits. Additionally, the percentage of heavy elements in the soil and sediments of the spring was measured using the PGNAA method with a 5 mCi Am-Be neutron source. The results show that the percentages of lead and other heavy elements are well below the permissible limits, posing no significant risk to users. Therefore, the use of Garab Hot Spring for therapeutic and recreational purposes is recommended.

ICHLERA11 – 59

Natural Radioactivity and Ingestion Dose Due to the Consumption of Popular Instant Noodle Brands in Malaysia

Mayeen Uddin Khandaker[1,2,*], Amira Shafiqa Binti Md. Kamsan[3], Z. Siti Rozaila[1], S.E. Lam[1], Yusoff Mohd Amin[3], D.A. Bradley[1,4]

[1]*Applied Physics and Radiation Technologies Group, CCDCU, School of Engineering and Technology, Sunway University, 47500 Bandar Sunway, Selangor, Malaysia*
[2]*Faculty of Graduate Studies, Daffodil International University, Daffodil Smart City, Birulia, Savar, Dhaka 1216, Bangladesh*
[3]*Department of Physics, Faculty of Science, Universiti Malaya, 50603, Kuala Lumpur, Malaysia*
[4]*Department of Physics, University of Surrey, Guildford, GU2 7XH, United Kingdom*

Corresponding author's email address: mu_khandaker@yahoo.com

Abstract:

Nowadays, most of the people in the world including the Malaysians are consuming instant noodles due to some favourable reasons; readily available, easy to prepare, cheap, tasty, and fast lifestyles. Over the years, Malaysia has become an attractive noodles market in the world with the highest consumption of instant noodles and it is currently become a very attractive fast food to Malaysian citizen especially to students, children and people who have busy lifestyles. Thus, a research was conducted to assess the natural radionuclides concentrations in widely consumed instant noodles in Malaysia. A variety of popular brands of instant noodles samples were collected directly from the AEON supermarket of Mid Valley megamall, Kuala Lumpur city. The prevailing concentration of naturally occurring radioactive materials in the research samples was determined by using a HPGe gamma ray spectrometer. Present analyses show that the Maggi curry produced in Malaysia contain the highest activity for the ^{226}Ra and ^{232}Th radionuclides. Overall, the activity concentrations (Bq kg^{-1}) of ^{226}Ra, ^{232}Th and ^{40}K are in the ranges of 0.90±0.11–1.99±0.16, 0.10±0.20–1.47±0.21 and 20.72±1.43–84.46±4.21, respectively. The annual effective dose were estimated following the consumption characteristics of instant noodles by the local populace, and found to be below than the allowed limit suggested by UNSCEAR. Hence, the sample noodles from this study are unharmed for consumption.

ICHLERA11 – 60

Impact of BaO and CaO on the Radiation Shielding Properties of BaO-Na_2O-Al_2O_3-B_2O_3-CaO Glass Systems

M. I. Sayyed[1], M Rashad[2], M. U. Khandaker[3,4], S. N. Mat Nawi[3]

[1]*Department of physics, Faculty of Science, Isra University, Amman – Jordan*
[2]*Advanced Materials Research Laboratory, Department of Physics, Faculty of Science, University of Tabuk, Tabuk, 71491, Saudi Arabia*
[3]*Applied Physics and Radiation Technologies Group, CCDCU, School of Engineering and Technology, Sunway University, 47500 Bandar Sunway, Selangor, Malaysia*
[4]*Faculty of Graduate Studies, Daffodil International University, Daffodil Smart City, Birulia, Savar, Dhaka, 1216, Bangladesh*

Corresponding author's email address: mohammed.alsyyed@iu.edu.jo

Abstract:

In an effort to provide better radiation shielding than traditional materials like lead, lead composites, and concrete, researchers are currently working to develop new materials. For these purposes, glass systems based on heavy metal oxides (HMOs) have garnered a lot of interest in recent years. In this study, we will examine the effect of increase the concentrations of BaO and CaO on the radiation shielding properties of the $xBaO\text{-}15Na_2O\text{-}10Al_2O_3\text{-}(70\text{-}2x)B_2O_3\text{-}(x+5)CaO$, (x=5, 10 and 15 mol%) glass systems. Different radiation shielding parameters including the mass/linear attenuation factors, the half/tenth value layers and the radiation protection efficiency have been calculated using Phy-X software. It was found that as photon energy increased, the transmitted percentage of photons (TF) via the suggested glasses increased, but as glass sample thickness increased, the TF decreased. Additionally, the BaO and CaO addition improved the glasses' effectiveness against radiation. The glass sample with composition of $15BaO\text{-}15Na_2O\text{-}10Al_2O_3\text{-}40B_2O_3\text{-}20CaO$ has the lowest mean free path. This sample possesses the highest linear attenuation coefficient and thus we can conclude that it has the best gamma ray shielding performance. Based on the results acquired, it appears that the prepared glasses would benefit greatly from the addition of BaO and CaO to their gamma radiation attenuation factors.

ICHLERA11 – 63

Investigations on Gamma Ray Shielding Parameters of Zinc Boro-Aluminosilicate Glass

Yahaya Saadu Itas[1,2,3,*], Mayeen Uddin Khandaker[2,*], Dauda Abubakar[1,3]

[1]*Department of Physics, Bauchi State University, Gadau -Nigeria*
[2]*Applied Physics and Radiation Technologies Group, CCDCU, School of Engineering and Technology, Sunway University, 47500 Bandar Sunway, Selangor, Malaysia*
[3]*Nanoscience and Technology Research Group, Department of Physics, Bauchi State University, Gadau-Nigeria*

Corresponding author's email address: yitas@basug.edu.ng

Abstract:

The current research will investigate the performance of zinc boro-aluminosilicate glasses as gamma-ray shields. The mass attenuation coefficients (μ/ρ) of the chosen glasses will be determined using the both Phy-x/PSD and WinXcom codes. Values obtained will be used to compute the half-value layer, effective atomic number, mean free path, and energy exposure buildup factors. Taken from the results, the EBFs for the current glasses will be observed in the low energy region (in order of unity at E ¼ 0.015 MeV) and then in the high-photon energy region. The results obtained for various shielding parameters will be used to explain gamma ray shielding of the zinc boro-aluminosilicate glass.

ICHLERA11 – 64

Design and Evaluation of Borate Glasses Doped with Multiple Components for Effective Low-Energy Radiation Shielding

Sabina Yasmin[1], M. I. Sayyed[2,3], Taha A. Hanafy[4], S. Abdullah[1], M. R. I. Faruque[1], Mayeen Uddin Khandaker[5]

[1]*Department of Space Science Centre (ANGKASA), Faculty of Institute of Climate Change, University Kebangsaan Malaysia, 43600 UKM, Bangi, Selangor, Malaysia*
[2]*Department of Physics, Faculty of Science, Isra University, Amman, Jordan*
[3]*Department of Physics and Technical Sciences, Western Caspian University, Baku, Azerbaijan*
[4]*Department of Physics, Faculty of Science, University of Tabuk, Tabuk, Saudi Arabia*
[5]*Applied Physics and Radiation Technologies Group, CCDCU, Sunway University*

Corresponding author's email address: sabinayasmin309@gmail.com

Abstract:

This work examined the low energy radiation shielding properties of a Bi_2O_3- and ZnO-doped borosilicate glass system. The radiation shielding factors for the glasses were determined to study the relationship between the Bi_2O_3 and ZnO contents in the glasses against their low gamma ray shielding abilities, as well as the effect that the energy of the radiation source has on the characteristics of the glass. The results demonstrated a positive relation between the amount of ZnO and Bi_2O_3 in the glasses and the mass attenuation coefficients. The results also showed a positive relation between the radiation protection efficiency and the amount of ZnO and Bi_2O_3 in the glasses. The glass sample which contains 18 mol% of Bi_2O_3 has the lowest linear attenuation coefficient (LAC) values, whereas the glass with 30 mol% Bi_2O_3 has the highest LAC values. The mean free path of the glasses was compared with other commercial glasses in order to test the effectiveness of these glasses in low energy radiation shielding applications. The glass with highest Bi_2O_3 content has lower MFP and thus better attenuation performance than some commercial glasses.

ICHLERA11 – 65

Assessment of Annual Occupational Dose for Dentists and Nurses at Three Dental Radiology Departments in Saudi Arabia

H. Salah[1,2*], Omer Mahgoub[3], Nisreen Tamam[4], M. Alkhorayef[5,] D.A. Bradley[6,7,] A Sulieman[8]

[1]*INAYA Medical Collage, Nuclear Medicine Department, Riyadh, Saudi Arabia*
[2]*College of Medical Radiologic Science, Sudan University of Science and Technology, Khartoum, Sudan*
[3]*Department of Radiological Sciences, National Ribat Univerity, Khartoum, Sudan*
[4]*Department of Physics, College of Sciences, Princess Nourah bint Abdulrahman University, P.O Box 84428, Riyadh, 11671, Saudi Arabia*
[5]*Department of Radiological Sciences, College of Applied Medical Sciences, King Saud University, Riyadh, Saudi Arabia*
[6]*Applied Physics and Radiation Technologies Group, CCDCU, Sunway University, Malaysia*
[7]*School of Mathematics and Physics, University of Surrey, Guildford, United Kingdom*
[8]*Department of Radiological Sciences, College of Applied Medical Sciences- Al-Ahsa, King Saud bin Abdulaziz University for Health Sciences*

Corresponding author's email address: hassan.salah.ibrahim1@gmail.com

Abstract:

This study aims to quantify the annual personal dose equivalent (mSv) for nurses and dentists at three dentistry departments. In this study, the occupational yearly exposure was quantified for 35 (71% (25)) nurses and 29% (10(29%). Calibrated optical stimulating-luminescent dosimeters (OSL) (Al2O3:C) were used in the three departments. These badges were read using an automatic OSL reader. The overall annual mean and range of the dentist's and nurses' personal dose equivalent (mSv) were 0.62 (0.12–0.76 mSv). Respectively. Occupational exposure varied 16%, 27.7%, and 8.2% for the Dammam, Al Ahsa, and Al Khobar Dental departments. The yearly personal dose equivalent is relatively low or comparable with previously published studies. Nurses received lower occupational exposure due to the variation in their workload and experience in dental radiography. Although the average annual personal dose equivalent for dental radiography personnel is 3.67% of the yearly dose (20 mSv).

ICHLERA11 – 66

Radiation Dose Assessment on Consumer Products Containing Naturally Occurring Radioactive Materials in Malaysia

N. Z. H. Abu Hanifah[1], S. Hashim[1,2], Halmat J. Hassan[3], M.R. Fahmi[4] & M.S.M. Sanusi[a]

[1]Department of Physics, Faculty of Science, Universiti Teknologi Malaysia, Johor, Malaysia
[2] Ibnu Sina Institute for Scientific and Industrial Research (ISISIR), Universiti Teknologi Malaysia, Johor, Malaysia
[3] Department of Physics, College of Education, University of Sulaimani, Sulaimani, Kurdistan-Iraq
[4] School of Physics, Universiti Sains Malaysia, Pulau Pinang, Malaysia

Corresponding author's email address: nzatihani@gmail.com

Abstract:

In this study, radiation dose assessments were conducted for various usage scenarios of consumer products containing naturally occurring radioactive materials (NORMs) to evaluate the risk of external dose exposure to the consumer. A high-resolution gamma-ray spectrometry system was used to measure the activity concentrations of radionuclides in the sample. Meanwhile, to estimate the effective dose received by the public, the Geant4 Monte Carlo simulation was used along with the ICRP-110 voxel-based adult reference computational phantom. The results revealed that the activity concentration for certain radionuclides in the lantern mantle, pendant, glass disc, undergarment, ion paint, and energy card saver samples exceed the exemption limit of 1, 1 and 10 Bq g^{-1} for ^{238}U, ^{232}Th and ^{40}K, respectively. Furthermore, the annual effective dose estimated in these samples; pendant (2.81 mSv y^{-1}), glass disc (2.16 mSv y^{-1}), energy card saver (1.35 mSv y^{-1}), undergarment (1.57 mSv y^{-1}) and ion paint (1.51 mSv y^{-1}) exceeding the International Commission on Radiological Protection (ICRP) recommended dose limit of 1 mSv y^{-1} for members of the general public. As prolonged usage of these products may raise the potential of harmful doses, continuous supervision from the regulatory body is essential to reduce the possible harm from unnecessary radiation exposure. In light of this, the decision regarding selling approval or prohibition of consumer products containing radioactive substances should be justified by considering the benefits offered by such products.

ICHLERA11 – 68

The Impact of High Specific Activity Radioactive Iodine (I-131) on Hyperthyroidism Response Rate

Mohammed Alruwaili[1*], M. Alkhorayef[2], A. Sulieman[3], D.A. Bradley[4,5]

[1]Biomedical Physics Department, *King Faisal Specialist Hospital and Research Center, Riyadh, Saudi Arabia*
[2]*Department of Radiological Sciences, College of Applied Medical Sciences, King Saud University, Riyadh, Saudi Arabia*
[3]*Department of Radiological Sciences, College of Applied Medical Sciences- Al-Ahsa, King Saud bin Abdulaziz University for Health Sciences*
[4]*Applied Physics and Radiation Technologies Group, CCDCU, Sunway University, Malaysia*
[5]*School of Mathematics and Physics, University of Surrey, Guildford, United Kingdom*

Corresponding author's email address: mohamedr@kfshrc.edu.sa

Abstract:

Radioactive iodine (I-131), or RAI has been commonly used to treat both benign and malignant thyroid conditions since the 1940s. Therapy aims to treat hyperthyroidism by destroying sufficient thyroid tissue to render the patient either euthyroid or hypothyroid. The specific activity of I-131, which is a measure of its radioactive strength, has been suggested to influence treatment outcomes. This study aims to investigate the correlation between high specific activity I-131 and hyperthyroidism response rates. Iodine-131 is a beta-emitting radionuclide with a maximum energy of 0.61 MeV, average energy of 0.192 MeV, and a range in the tissue of 0.8 mm. It remains the radionuclide of choice for therapy because of its long half-life of just over eight days. A retrospective analysis was conducted on patients who received I-131 therapy for hyperthyroidism at a specific institution. All patients carried out the procedure at King Faisal Specialist Hospital and Research Center. Patients were categorized based on the specific activity of the I-131 administered. In our study the choice made to use high dose of Iodine-131in purpose to achieve high cure rate. During nine consecutive years, a total of 538 patient were treated with a response rate range from 70%-80% and 20%-30% needed a second dose of 131I-RAI who achieved a cure after second dose. However, in the last year, the response rate was low about 50%, more than 20 patients (40-50%) needed second dose of therapy. The primary outcome was the rate of successful treatment, defined as achieving euthyroidism or hypothyroidism within a specified timeframe. Secondary outcomes included the incidence of adverse effects and the need for repeat I-131 therapy. The study found a significant association between high specific activity I-131 and higher rates of successful treatment. Patients who received I-131 with a higher specific activity were more likely to achieve euthyroidism or hypothyroidism without requiring additional therapy. Furthermore, there was no significant difference in the incidence of adverse effects between groups.The findings of this study suggest that high specific activity I-131 may be a valuable strategy for improving the efficacy of hyperthyroidism treatment. By utilizing I-131 with higher specific activity, healthcare providers may be able to achieve better outcomes for patients with hyperthyroidism. Further research is needed to explore the optimal specific activity for I-131 therapy and to identify potential factors that may influence treatment response. Patient preparation ensures efficacy of RAI and reduces the potential complications. Important issues like the consent procedure, pregnancy issues and timing of stopping medication, restarting therapy and possible complications of therapy should be discussed with the patient.

ICHLERA11 – 69

Evaluation of Radiation Exposure and Projected Effects from Cardiac Interventional Procedures

Abdelmoneim Sulieman[1], Mohamed Alkhorayef[2], Khalid Alzimami*[1]

[1]Department of Radiological Sciences, College of Applied Medical Sciences, King Saud Bin Abdulaziz University for Health Sciences, P.O.Box 2477, Al-Ahsa , Al Hofuf 31982, Saudi Arabia
[2]Department of Radiological Sciences, College of Applied Medical Sciences, King Saud University, PO Box 10219, Riyadh 11433, Saudi Arabia

Corresponding author's email address: kzimami@ksu.edu.sa

Abstract:

Medical exposure to ionizing radiation during interventional examinations has harmful effects on exposed patients, such as cancer effects or tissue reactions in certain thresholds. Cardiac catheterization procedures are frequently performed at cardiac catheter laboratories for a wide range of clinical indications. This research intended to evaluate the patient's radiation dose during percutaneous coronary interventions (PCI)) cardiac catheterization procedures. In total, 150 procedures were carried out in four hospitals in Riyadh region, Saudi Arabia. Calibrated Kerma area product meters were used to quantify the patient doses. The National Radiological Protection Board (NRPB) software program extrapolated the effective dose. The mean KAP (Gy.cm2) per PCI procedure were 8.02±0.75 (6.86-9.74), 5.91±0.52 (5.02-6.99), 7.64±0.63 (6.24-8.51), and 12.94±3.96 (9.51-22.71) for Hospitals A, B, C and D, respectively. The overall effective doses ranged from 4.2 to 20 mSv per procedure. Patients' effectiveness is compared to the recently published studies. The diagnostic reference level (DRL) was proposed based on the third quartile value of the PCI procedure.

ICHLERA11 – 70

Assessment of Occupational Exposure and Safety for Customs and Border Protection Personnel in Saudi Arabia

Almubarak Siddig[1], H. Salah[2,3], M. Alkhorayef[4], Essam Alkhybari[5], Dahlan Tahir[6], and D.A.Bradley[7,8], A. Sulieman[9]

[1]*Medical Physics department, King Abdulaziz Hospital, National Guard, Saudi Arabia*
[2]*INAYA Medical Collage, Nuclear Medicine Department, Riyadh, Saudi Arabia*
[3]*College of Medical Radiologic Science, Sudan University of Science and Technology, Khartoum, Sudan*
[4]*Department of Radiological Sciences, College of Applied Medical Sciences, King Saud University, P.O Box 10219 Riyadh, 11433, Saudi Arabia*
[5]*Prince Sattam Bin Abdulaziz University, College of Applied Medical Sciences, Radiology and Medical Imaging Department, Alkharj, Saudi Arabia*
[6]*Department of Physics, Hasanuddin University, Makassar, 90245, Indonesia*
[7]*Applied Physics and Radiation Technologies Group, CCDCU, Sunway University, Malaysia*
[8]*School of Mathematics and Physics, University of Surrey, Guildford, United Kingdom*
[9]*Department of Radiological Sciences, College of Applied Medical Sciences, King Saud Bin Abdulaziz University for Health Sciences, P.O.Box 2477, Al-Ahsa , Al Hofuf 31982, Saudi Arabia*

Corresponding author's email address: Abdelmoneim_a@yahoo.com

Abstract:

Linear Accelerators are used for cargo and container inspection at borders. Port generally uses a high-energy linear accelerator (LINAC) to produce cargo and container inspection X-ray images. Customs and Border Protection (CBP) personnel may expose ionizing exposures that can pose significant health risks if not adequately managed. This study aims to assess the occupational exposure and safety measures implemented for CBP personnel in the Kingdom. A cross-sectional study was conducted among CBP workers in Saudi Arabian various borders and customs points. In total, 15 workers at the border customs inspection had a fixed linear accelerator that performed the car and cargo inspection. Personal dose equivalent (PDE) was quantified using Optically stimulated luminescent dosimeters (OSL). PDE were quantified in terms of Hp (10) and Hp (0.07). The study was conducted over two years for one radioactive facility with the same physical and structural characteristics. The total average, standard deviation, and range for customs workers in 2022 were for Hp (0.07) 0.885±0.097 (0.741-1.065) & Hp (10) 0.84±0.072 (0.714-0.944) and in 2023 were for Hp (0.07) 0.88±0.093 (0.85-1.062) & Hp (10) 0.85±0.104 (0.694-1.123), respectively. This study highlights the need for enhanced occupational safety and health measures for CBP personnel in Saudi Arabia. Implementing effective training programs, providing adequate PPE, and conducting regular health assessments can help mitigate the risks associated with their work. Further research is necessary to identify specific hazards and develop targeted interventions to protect the health and well-being of CBP personnel.

ICHLERA11 – 71

Radiation Dosimetry and Radiological Risk Assessment for Orthopedic Department Personnel during Surgeries

Mohamed Alkhorayef[1], Hassan Salah[2,3*], Omer Mahgoub[4], D.A. Bradley[5,6,] A Sulieman[7]

[1]*Department of Radiological Sciences, College of Applied Medical Sciences, King Saud University, P.O Box 10219 Riyadh, 11433, Saudi Arabia*
[2]*INAYA Medical Collage, Nuclear Medicine Department, Riyadh, Saudi Arabia*
[3]*College of Medical Radiologic Science, Sudan University of Science and Technology, Khartoum, Sudan*
[4]*Department of Radiological Sciences, National Ribat Univerity, Khartoum, Sudan*
[5]*Applied Physics and Radiation Technologies Group, CCDCU, Sunway University, Malaysia*
[6]*School of Mathematics and Physics, University of Surrey, Guildford, United Kingdom*
[7]*Department of Radiological Sciences, College of Applied Medical Sciences, King Saud Bin Abdulaziz University for Health Sciences, P.O.Box 2477, Al-Ahsa , Al Hofuf 31982, Saudi Arabia*

Corresponding author's email address: malkhorayef@ksu.edu.sa

Abstract:

Staff occupational radiation exposure is limited to 20 mSv yearly to avoid tissue reactions or deterministic effects and minimize the probability of cancer effects. The orthopedic staff team is occupationally exposed to ionizing radiation while manipulating the procedures in the operating room (OR). Recent reports showed that some personnel received a high annual occupational dose beyond the annual limits, and tissue reaction, and cancer effects were also reported. Therefore, a precise assessment of the personal dose equivalent, Hp (10, mSv), is recommended. The purpose of this research is to quantify the annual Hp (10) (mSv) per year for operating room (OR) staff. The study population consisted of 100 medical professionals (50 (50%)) were nurses, 42 (42%) were Surgeons, and 8 (8%) were Anesthesia Technicians) working in three different hospitals in Dammam, Al Ahsa, and Al Khobar, Saudi Arabia. The Occupational exposures were quantified using calibrated optical stimulating-luminescent dosimeters (OSL) (Al2O3:C). The Hp (10 (mSv)) total average and standard deviation for Orthopaedic personnel were 0.58±0.12, 0.55±0.11, and 0.71±0.3 for Dammam, Al Ahsa, and Al Khobar, respectively. The amount of occupational exposure depends on the type of procedure, workload, and exposure factors settings. Staff yearly exposure is below the annual limits of 20 mSv; nonetheless, this external dose is deemed excessive compared to the present workload.

ICHLERA11 – 72

Characterization of Metallic Oxide Nanomaterials Thin Film for Radiation Shielding Applications

Mohamed Abdulsattar Al-Balushi[1], S.F. Abdul Sani[2], Tajuddin, Hairul Anuar[3]

[1]*Department of Physics,Faculty of Scince, Universiti Malaya,Kuala Lumpur, Malaysia*
[2]*Department of Physics,Faculty of Scince, Universiti Malaya,Kuala Lumpur, Malaysia*
[3]*Department of Chemistry, Faculty of Science, Universiti Malaya, Kuala Lumpur, Malaysia*

Corresponding author's email address: mood.str@gmail.com

Abstract:

Lead-based products are still the major option for ionization radiation protection, their environmental drawbacks and high toxicity restrict their performance, requiring the development of less expensive, compatible, eco-friendly, and lightweight alternatives. This study explores the development of lead-free, lightweight, and non-toxic materials for X-ray radiation protection using zinc oxide nanorods (ZnONRs) and zinc oxide nanoparticles (ZnONPs) combined with polyethylene oxide (PEO) with various weight percentages (wt%) of bismuth (Bi). These materials will be fabricated into nano and micro thin films by using chemical bath deposition (CBD) techniques. The parameters such as linear and mass attenuation coefficients, half-value layer (HVL), and density will be calculated to evaluate the effectiveness of the materials and to determine their ability to attenuate X-rays e. The thin films are expected to attenuate the x-ray energy range (50-120 kVp), lighter, less toxic, and more environmentally friendly. The results will contribute the development of radiation protective materials by using nanotechnology, providing environmentally friendly and health-conscious options appropriate for medical, industrial, and other protection applications.

ICHLERA11 – 73

Vertical Miscentering and Effect on Radiation Dose to The Lens in Computed Tomography Head Examination: A Systematic Review

Izdihar Kamal[1*], Mohd Khairul Fazwan Mohd Yusof[2,3] ,
Muhammad Khalis Abdul Karim[1], Nur Anis Izzati Che Mut[2], Sulayman Muhammad Kabeer[1],
Aminatul Saadiah Abdul Jamil

[1]Department of Physics, Faculty of Science, Universiti of Putra Malaysia, Seri Kembangan 43400, Selangor, Malaysia
[2]Department of Medical Imaging, School of Health Sciences, KPJ Healthcare University Nilai 71800, N. Sembilan, Malaysia
[3]Jabatan Radiologi, Hospital Sultan Abdul Aziz Shah Persiaran Mardi-UPM 43400 Serdang Selangor
[4]Health Technology Industry Programme, Faculty of Science & Technology
Universiti Sains Islam Malaysia

Corresponding author's email address: izdiharkamal@upm.edu.my

Abstract:

Introduction: The increased use of Computed Tomography to evaluate pathological and traumatic injuries to the brain and the skull has raised concern regarding the radiation dose received by the radiosensitive organ especially the eye lens. This study was intended to review available literature and provide systematically acquired evidence regarding the effect of vertical miscentering on the radiation dose to the lens in plain CT head examination. Methodology: A systematic review of current literature was conducted using the EBSCOhost interface comprised of electronic databases MEDLINE and CINAHL. Results: The extensive search yielded a total of 59 relevant articles which were thoroughly assessed and evaluated. After thorough screening 9 articles were selected for full-text screening and 5 articles were included in the review after the full-text screening. The finding concluded that vertical miscentering had significant influences on the absorbed dose to the lens. Conclusions: All reviewed articles consistently indicated an inverse-proportional relationship between vertical miscentering and lens doses. The reviewed literature consistently emphasizes that centering is pivotal in determining both the radiation dose to the lens and the overall image quality. Implication for practice: Properly center the patient head to the gantry isocenter must be common practise and education channel is the most practical way of developing the skills.

SPONSOR

ALYPZ

WORKING TOWARDS SAFER ENVIRONMENT

INTRODUCTION

Alypz Sdn. Bhd. (formerly known as Asia Lab) was incorporated in 1985 and was the first company in Malaysia that has dual accreditation from the Malaysian Atomic Energy Licensing Board and Ministry of Health. Alypz pioneered the Technologically Enhanced Naturally Occurring Radioactive Material (TENORM) management programme in Malaysia in early 90's. Today, Alypz is the market leader serving all the top oil and gas companies in NORM/ TENORM monitoring services in ASEAN region, as well as providing comprehensive radiation services across various industries involved with radioactive materials. With strict adherence to our Quality Management System and MS ISO/IEC 17025, the company has demonstrated its excellent ability to be a primary radiation service provider to all its clients for the past 30 years.

MISSION

To help customers creating a safe and secure environment for their employees, business partners and communities around them by delivering quality services and industry relevant best practises.

VISION

To be one-stop solution provider for occupation health, safety, security and environment assessment, certification and advisory services.

SERVICES OFFERED

1 Radiological Services

- NORM/TENORM Monitoring
- Radiation and Environmental Assessment Programme
- TENORM Decontamination Services
- Radiological Impact Assessment (RIA)
- Radiological Safety Analysis (RSA)
- Radiological Balance Analysis (RBA)

2 Industrial Hygiene Services

- CEM In-situ & Area Monitoring Services
- Chemical Decontamination
- Chemical Health Assessment (CHRA)
- Noise Risk Assessment
- Local Exhaust Ventilation (LEV)

3 Laboratory Services

- Radioactivity Laboratory (Gamma Spectrometry & Gross Alpha Beta Spectrometry)
- Radiation Dosimetry Services Lab (OSL)

4 Training

- Radiation Safety Awareness Training
- Radiation Safety Emergency Management Training
- TENORM Safety Awareness Training
- Radiation Protection Training for Officer
- HAZMAT Awareness Training
- Continuous Medical Education (CME)

5 Equipment Supplies

- RadiScan G1 Radiation Survey Meter
- Durridge RAD7 and RAD8 Radon Analyzer

6 Medical Radiation Services

- QA and Certification for Medical X-ray Facilities
- X-ray Room Certification
- Radiation Leakage & Scatter Test

7 Radiation Safety Services

- Radiation Protection & Consultancy Services
- Radiation Leak Test Services
- Radiation Protection Program
- Radiation Protection Emergency Plan
- Radiation Safety & Security Plan
- Import/Export and Transportation of Radioactive Source
- Disposal of Radioactive Materials
- Radiation Shielding Calculation






contact.us@alypz.com (general)
bd@alypz.com (marketing)
training.my@alypz.com (training)

fb.me/alypz.group

alypz